INEEL/EXT-02-01117
Revision 2
Project No. 021052

Health and Safety Plan for OU 7-10 Glovebox Excavator Method Project Operations

Bruce P. Miller
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Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Idaho Completion Project
Idaho Falls, Idaho 83415

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Approved by

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ABSTRACT

This health and safety plan establishes the procedures and requirements used to eliminate or minimize health and safety risks to personnel performing operational tasks within the Operable Unit 7-10 Glovebox Excavation Method Project operational areas at the Subsurface Disposal Area of the Radioactive Waste Management complex at the Idaho National Engineering and Environmental Laboratory. This plan has been prepared to meet Occupational Safety and Health Administration standard, 29 *Code of Federal Regulations* 1910.120 (2002), "Hazardous Waste Operations and Emergency Response Requirements."

This plan contains the assessment and associated mitigation of safety, health, and radiological hazards for conducting operational activities within the Operable Unit 7-10 Project operations area. Safety, health, and radiological professionals assigned to support Operable Unit 7-10 Project operations will define the most appropriate hazard control and mitigation measures based on operations-specific conditions and will make changes to this plan and associated work control documents as appropriate.

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TABLES

ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	as low as reasonably achievable
ANSI	American National Standards Institute
CAM	constant air monitor
CAS	criticality alarm system
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	*Code of Federal Regulations*
CPR	cardiopulmonary resuscitation
D&D&D	deactivation, decontamination, and decommissioning
dBA	decibel A-weighted
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DSS	dust-suppression system
EPA	U.S. Environmental Protection Agency
ERO	Emergency Response Organization
FFA/CO	Federal Facility Agreement and Consent Order
FFS	Facility Floor Structure
FGE	fissile gram equivalent
FMM	fissile material monitor
GI	gastrointestinal
HASP	health and safety plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HEPA	high-efficiency particulate air
ICDF	INEEL CERCLA Disposal Facility

IDLH	immediately dangerous to life or health
IH	industrial hygienist
INEEL	Idaho National Engineering and Environmental Laboratory
ISMS	Integrated Safety Management System
JSA	job safety analysis
LEL	lower explosive limit
LO/TO	lockout and tagout
MCP	management control procedure
MSDS	material safety datasheet
NFM	nuclear facility manager
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NRR	noise reduction rating
OMP	Occupational Medical Program
OSHA	Occupational Safety and Health Administration
OU	operable unit
PC	performance criterion
PCB	polychlorinated biphenyl
PCM	personal contamination monitor
PEL	permissible exposure limit
PGS	Packaging Glovebox System
PPE	personal protective equipment
PRD	program requirements document
RadCon	Radiological Control
RCIMS	Radiological Control and Information Management System
RCM	*Radiological Control Manual*

RCRA	Resource Conservation and Recovery Act
RCS	Retrieval Confinement Structure
RCT	radiological control technician
ROD	record of decision
RW	radiological worker
RWMC	Radioactive Waste Management Complex
RWP	radiological work permit
SCBA	self-contained breathing apparatus
SDA	Subsurface Disposal Area
STD	standard
SWP	safe work permit
TLD	thermoluminescent dosimeter
TLV	threshold limit value
TPR	technical procedure
TRU	transuranic
TSDF	Treatment, Storage, and Disposal Facility
TWA	time-weighted average
UV	ultraviolet
VPP	Voluntary Protection Program
WAC	waste acceptance criteria
WCC	Warning Communications Center
WES	Weather Enclosure Structure
WMF	Waste Management Facility

Health and Safety Plan for OU 7-10 Glovebox Excavator Method Project Operations

1. WORK SCOPE

1.1 Purpose

This health and safety plan (HASP) identifies health and safety hazards and requirements used to eliminate or minimize the hazards during Operable Unit (OU) 7-10 Glovebox Excavator Method Project operations within the Subsurface Disposal Area (SDA) of the Radioactive Waste Management complex (RWMC), located at the Idaho National Engineering and Environmental Laboratory (INEEL). This HASP has been written to meet the requirements of the Occupational Safety and Health Administration (OSHA) *Code of Federal Regulations* (CFR) standard, 29 CFR 1910.120 (2002), "Hazardous Waste Operations and Emergency Response."

This HASP has been prepared to address OU 7-10 Project operational hazards and associated mitigation based on general operations within the OU 7-10 Project operationally controlled area at the RWMC. This HASP is applicable to all operational activities following construction through facility layup (but not including deactivation, decontamination, and decommissioning). This plan and additional job safety analyses (JSAs), operational technical procedures (TPRs), and management control procedures (MCPs) will further define OU 7-10 Project operational hazards, hazard mitigation, and procedural requirements as the facility begins operation and new hazards are identified. This HASP will be reviewed and revised, as appropriate, by OU 7-10 Project Industrial Hygiene, Industrial Safety, and Radiological Control (RadCon) operations personnel to ensure its effectiveness and suitability for OU 7-10 Project operations.

1.2 Applicability and Jurisdiction

Project operations will be conducted under the administrative controls of a safety analysis. Technical procedures, JSAs, and other appropriate project health and safety evaluations will be conducted to ensure operations are conducted in compliance with the facility authorization basis. Project operations will fall within the jurisdiction of the RWMC operations director. This HASP applies to all personnel conducting OU 7-10 Project operational activities in these areas.

1.3 Site Description of the Idaho National Engineering and Environmental Laboratory

The INEEL is a U.S. government-owned test site located (32 mi) west of Idaho Falls in southeastern Idaho (see Figure 1-1) and managed by the U.S. Department of Energy (DOE). The INEEL encompasses approximately 2,305 m^2 (890 mi^2) of the northeastern portion of the Eastern Idaho Snake River Plain. The Eastern Idaho Snake River Plain is a relatively flat, semiarid, sagebrush desert with predominant relief being manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures. Elevations on the INEEL range from 2,003 m (6,572 ft) in the southeast to 1,448 m (4,750 ft) in the central lowlands, with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer, a sole-source aquifer that flows beneath the INEEL and surrounding area. The aquifer is approximately 137 m (450 ft) below ground surface within the Site boundaries. Regional groundwater flow is southwest at average estimated velocities of 1.5 m/day (5 ft/day).

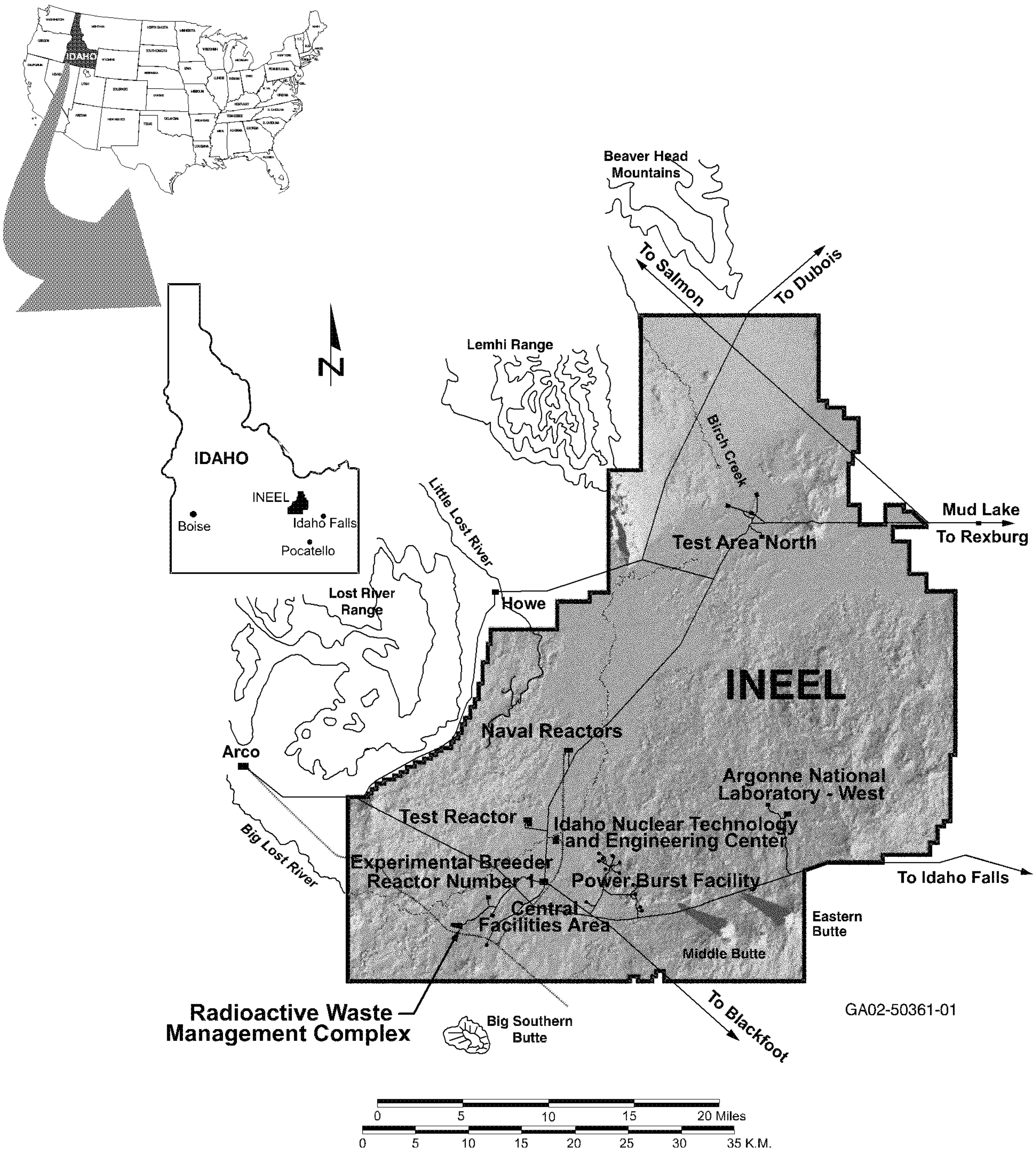

Figure 1-1. Map of the Radioactive Waste Management Complex at the Idaho National Engineering and Environmental Laboratory.

1.4 History

The U.S. Atomic Energy Commission initially established the Site in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the Site expanded its function and began accepting shipments of transuranic (TRU) radionuclides and radioactive low-level waste. In 1974, it was redesignated the Idaho National Engineering Laboratory, and then, in 1997, to reflect the expansion of its mission to include a broader range of engineering and environmental management activities, the name was changed to INEEL. Currently, the INEEL is used to support the engineering efforts and operations of the DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, and energy technology and conservation programs. The U.S. Department of Energy Idaho Operations Office (DOE-ID) has responsibility for the INEEL and delegates authority to operate the INEEL to government contractors. Bechtel BWXT Idaho, LLC, is the current management and operating contractor for the INEEL.

1.5 Background and Description of the Radioactive Waste Management Complex

The RWMC was established in the early 1950s as a disposal site for solid low-level waste generated by operations at the INEEL and other DOE laboratories. Radioactive waste materials were buried in underground pits, trenches, soil vault rows, and one aboveground pad (Pad A) at the SDA. Transuranic waste is kept in interim storage in containers on asphalt pads at the Transuranic Storage Area. Radioactive waste from the INEEL was disposed of in the SDA starting in 1952. Rocky Flats Plant (RFP)[a] TRU waste was disposed of in the SDA from 1954 to 1970. Post 1970 transuranic waste is kept in interim storage in containers on asphalt pads at the Transuranic Storage Area.

In August 1987, in accordance with the Resource Conservation and Recovery Act (RCRA), Section 3008(h) (42 USC § 6901 et seq., 1976), the DOE and the U.S. Environmental Protection Agency (EPA) entered into a Consent Order and Compliance Agreement (DOE-ID 1987). The Consent Order and Compliance Agreement required DOE to conduct an initial assessment and screening of all solid and hazardous waste disposal units at the INEEL and set up a process for conducting any necessary corrective actions. On July 14, 1989, the EPA (under the authority granted to them by the Comprehensive Environmental Response, Compensation and Liability Act [CERCLA] of 1980 [42 USC § 9601 et seq., 1980], as amended by the Superfund Amendments and Reauthorization Act of 1986 [Public Law 99-499, 1986]) proposed that the INEEL be listed on the National Priorities List (54 FR 29820). The final rule that listed the INEEL on the National Priorities List was published on November 21, 1989, in 54 FR 48184 (1989). On December 4, 1991, because of the INEEL's listing on the National Priorities List, DOE, EPA, and the Idaho Department of Health and Welfare entered into the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991). The Federal Facility Agreement and Consent Order (FFA/CO) established the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with CERCLA (42 USC 6901 et seq., 1976), RCRA, and the Idaho Hazardous Waste Management Act.

a. The Rocky Flats Plant, located 26 km (16 mi) northwest of Denver, Colorado, was renamed the Rocky Flats Environmental Technology Site in the mid-1990s. In the late 1990s it was again renamed to its present name, the Rocky Flats Plant Closure Project.

1.6 Background and Description of the Operable Unit 7-10 Glovebox Excavator Method Project

Operable Unit 7-10 (see Figure 1-2) was identified for an interim action under the FFA/CO (DOE-ID 1991), as described in the Record of Decision: Declaration of Pit 9 at the Radioactive Waste Management complex Subsurface Disposal Area at the Idaho National Engineering Laboratory, Idaho Falls, Idaho (DOE-ID 1993). Under the FFA/CO, the INEEL is divided into 10 waste area groups (WAGs). These WAGs are further subdivided into OUs. The RWMC has been designated as Waste Area Group 7 and was subdivided into 13 OUs. Pit 9 comprises OU 7-10.

The 1993 OU 7-10 Record of Decision (ROD) (DOE-ID 1993) and the 1998 Explanation of Significant Differences specify environmental remediation of TRU waste from OU 7-10. Initially, remediation of OU 7-10 was to be conducted under a subcontract. Later, after experiencing delays, the remediation was divided into three stages:

- Stage I included the in situ TRU waste characterization through probe holes and core sample retrieval and analysis
- Stage II included the retrieval of all materials from a 20 × 20-ft area of the pit down to bedrock
- Stage III would rely on information obtained during Stages I and II to determine the appropriate interim action for the remainder of OU 7-10.

Stage II retrieval 90% design was developed between DOE-ID, the Idaho Department of Environmental Quality, and the EPA. It was a complex design that provided for methodical waste retrieval as well as precise recovery of in situ characterization data. Because the Stage II 90% design was time consuming to build and operate, DOE requested a schedule extension for its implementation. The Idaho Department of Environmental Quality and the EPA denied the request, which led DOE to implement a formal dispute resolution process described by the INEEL FFA/CO. As part of the dispute resolution process, INEEL conducted a study to find a safe, faster, and less costly means to conduct the Stage II retrieval demonstration. On July 23, 2001, the INEEL began a comparison of alternative methods to accomplish the Stage II waste retrieval demonstration at OU 7-10. As a result of this comparison, the Glovebox Excavator Method approach was recommended as the Stage II path forward because it provides the best balance of schedule, cost, and risk of the options analyzed (INEEL 2001).

The OU 7-10 Glovebox Excavator Method relies on a commercial excavator with the cab and operator located outside a confinement structure. Gloveboxes house material handling and packaging operations, and an insulated fabric enclosure isolates the confinement structure and the gloveboxes from the outside environment.

The specific objectives for the OU 7-10 Glovebox Excavator Method Project are to:

- Demonstrate waste zone material retrieval
- Provide information on any contaminants of concern present in the underburden
- Characterize waste zone material for safe and compliant storage
- Package and store waste onsite, pending decision on final disposition.

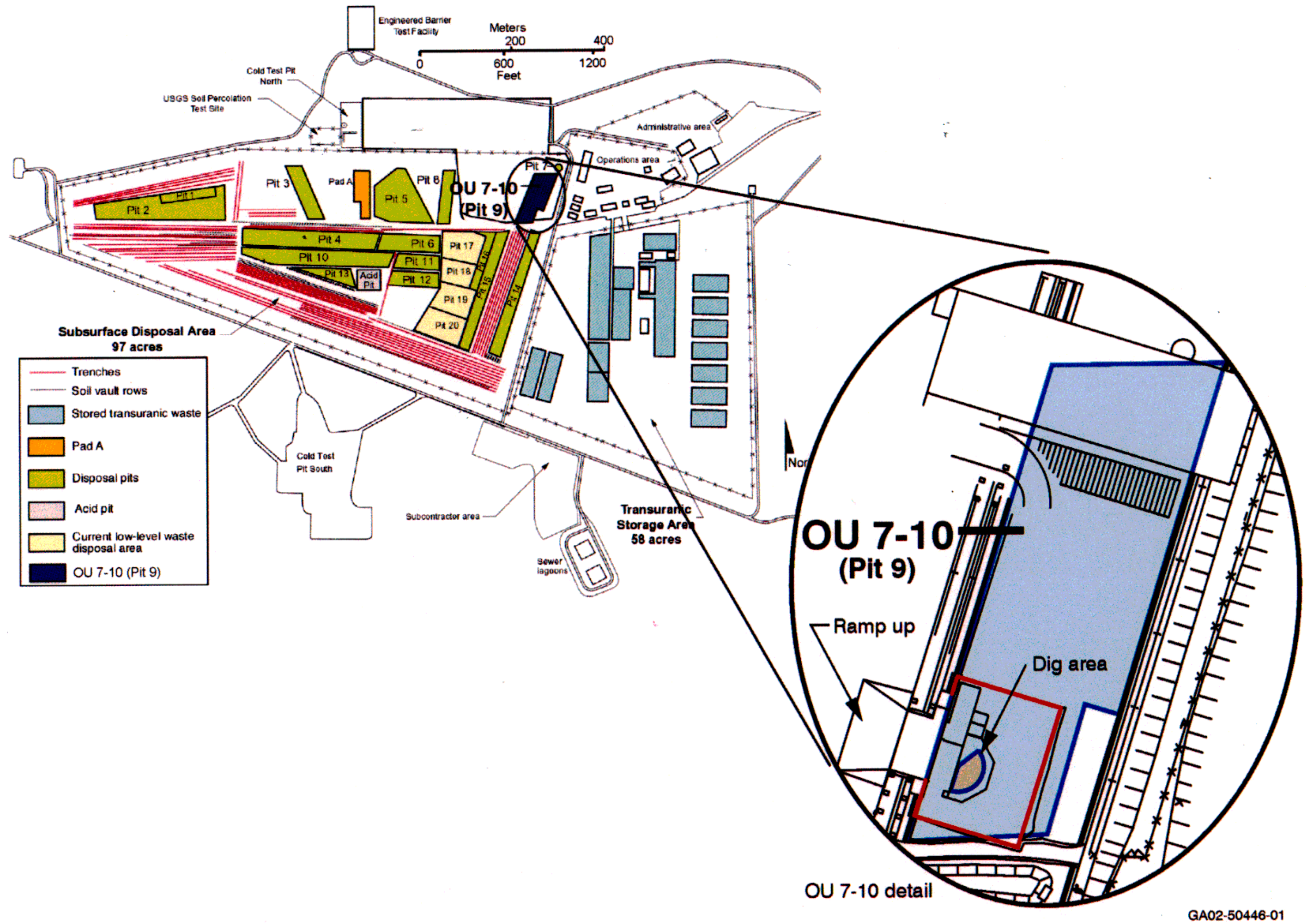

Figure 1-2. Location of dig area of Operable Unit 7-10 within the Subsurface Disposal Area at the Radioactive Waste Management Complex.

Facilities associated with the OU 7-10 Project are located at OU 7-10 and surrounding areas. The OU 7-10 Project excavation area is defined by a 20-ft × 145-degree arc down to but not including the underburden. The Project will remove at least 75 yd^3 of material from the waste zone in this arc and will sample the underburden. The excavation area was selected based on shipping records that indicate that this area contains high concentrations of volatile organic compounds and on recent probe data that indicate that one small portion of this area could contain a high concentration of TRU radionuclides.

1.7 Project Facility Overview

The project includes waste zone material excavation, sizing (when needed), sampling, packaging, assaying, and storage. Materials within the waste zone are placed primarily in 55-gal drums. A secondary capability exists for placing waste zone materials in 85-gal drums. The packaged material is then weighed, radioassayed, and placed into onsite CERCLA-compliant storage. The packaged material will then be stored onsite, pending decision on final disposition.

The project facilities include the Waste Management Facility-671 (WMF-671) Weather Enclosure Structure (WES) that houses the Facility Floor Structure (FFS), Retrieval Confinement Structure (RCS), a commercial excavator, and the Packaging Glovebox System (PGS) that comprises three gloveboxes attached to the RCS. Personnel support trailers, an assay system, and one or more CERCLA-compliant storage areas are next to the WMF-671 WES (see Figures 1-3 and 1-4).

The WMF-671 WES consists of a prefabricated steel frame with an insulated membrane that is tensioned over the frame to provide a tight-fitting shell. A structural floor placed over the ground provides a stable working surface for forklifts, personnel, and confinements. The WMF-671 WES provides vital support functions, such as operational lighting, localized radiant heating, life safety systems, fire detection and suppression, ventilation, and filtration of the exhaust air.

The RCS is constructed over the retrieval area and is a confinement for radiological and hazardous material releases during excavation and retrieval activities. The RCS is constructed of a steel ceiling, steel floor, and steel wall plates attached to a structural steel framework. The RCS is equipped with windows, sealed penetrations and interfaces, personnel vestibules, gloveports, an excavator confinement interface for operation of the excavation system, and a bank of high-efficiency particulate air (HEPA) filters that are inlets and outlets for the ventilation system.

The gloveboxes are constructed of a steel frame, stainless steel bottom, clear panels, gloveports with gloves, rail-mounted transfer carts, operator work platforms, and HEPA filter inlets for the ventilation system. Three packaging stations are included in each glovebox for loading waste into new drums. Each station is accessed through a port in bottom of the glovebox. The new drums and drum loadout ports and bag-out rings are within contamination control structures referred to as drum loadout enclosures.

The RWMC facilities located nearest to the project facilities are as follows:

- An OU 7-10 retrieval structure and rails, a process building, a chemical warehouse, and support facilities that were constructed during a Pit 9 Project by a previous contractor and then abandoned before use

- Activities being conducted at the SDA for removal of organic contamination in the vadose zone

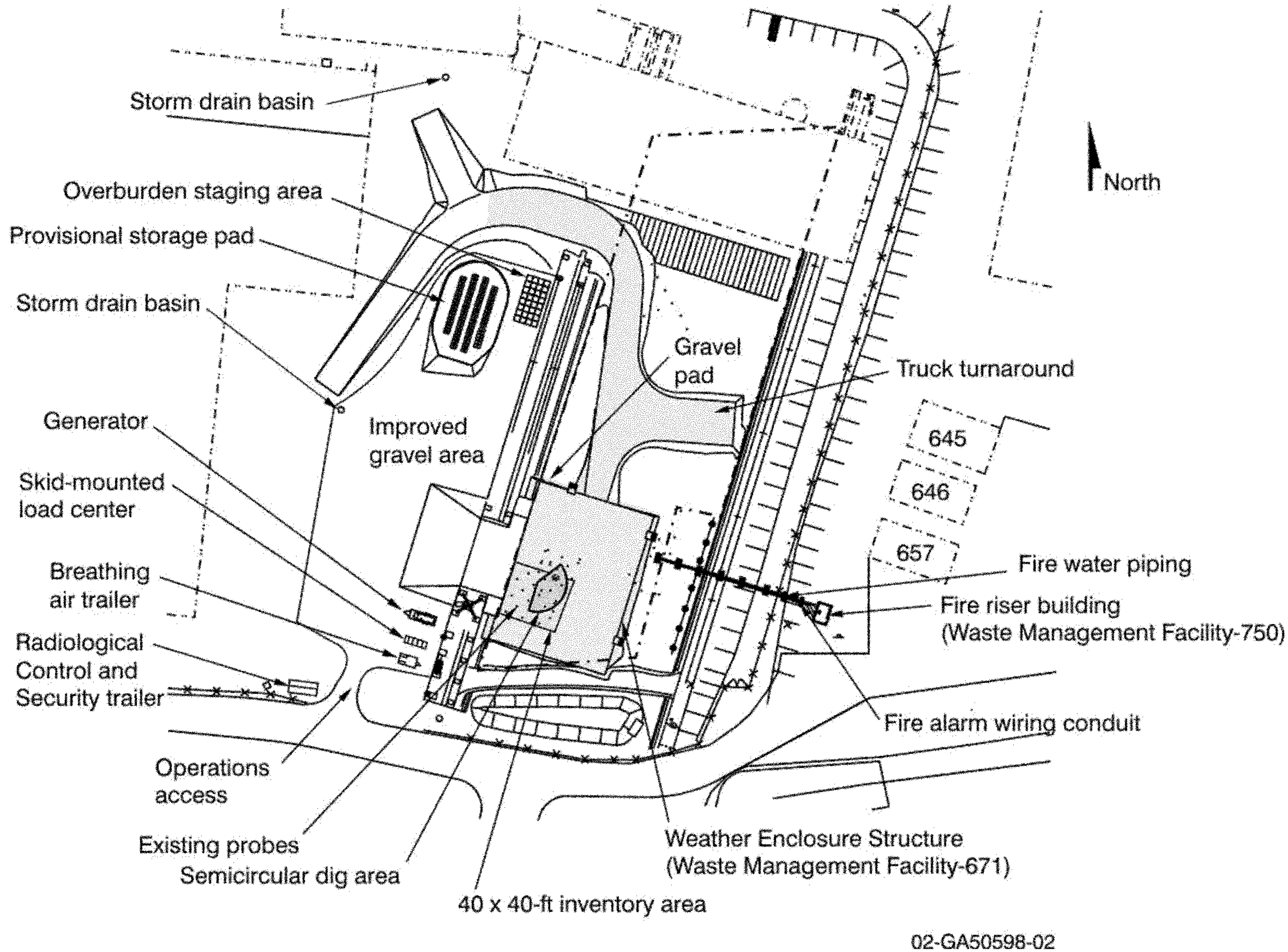

Figure 1-3. Plan view of the Operable Unit 7-10 Glovebox Excavator Method Project area showing project site structures.

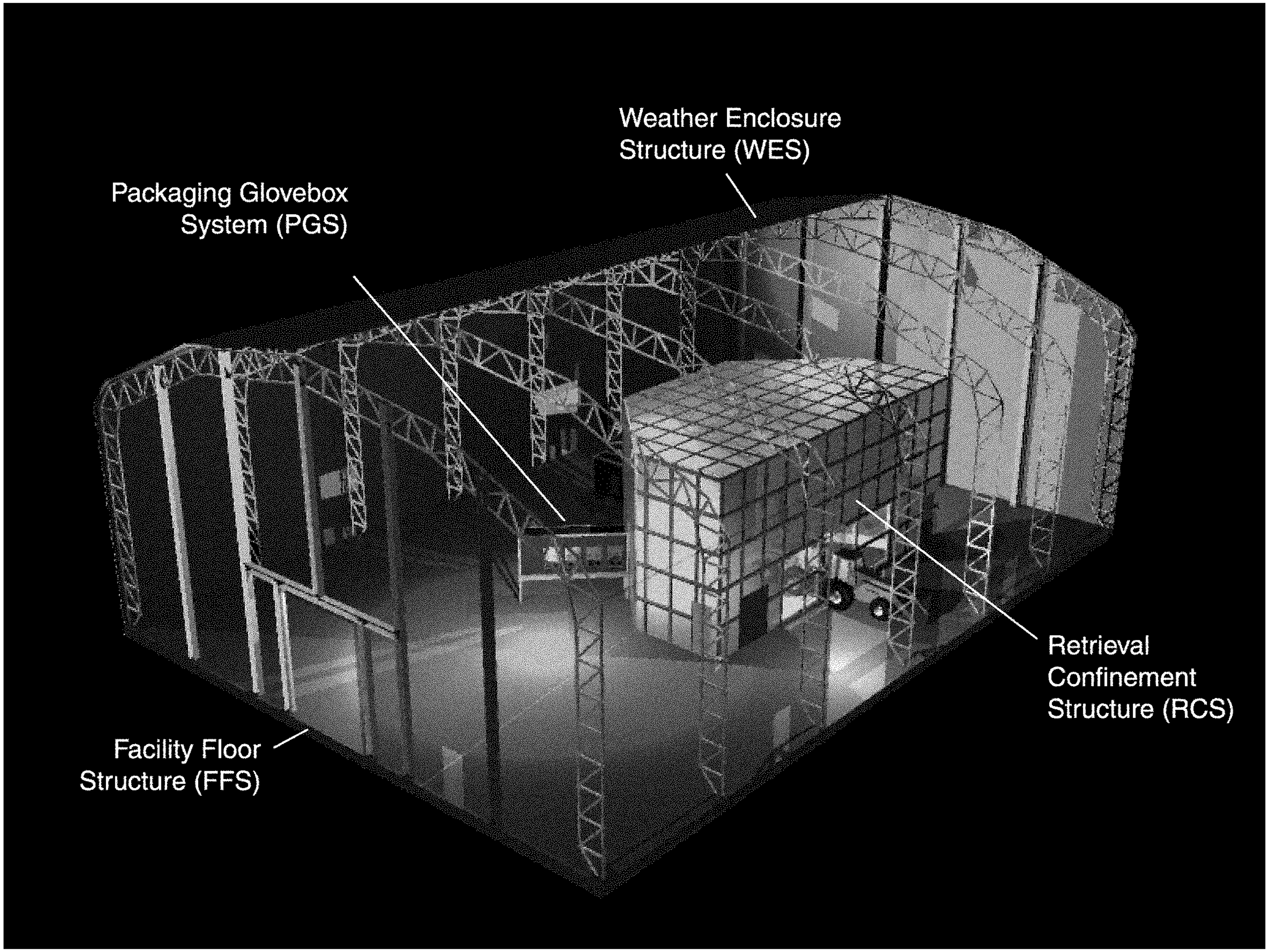

Figure 1-4. Waste Management Facility-671 Weather Enclosure Structure housing the Retrieval Confinement Structure and the Packaging Glovebox System.

- Active low-level waste pit at the SDA
- Heavy equipment storage shed (WMF-609)
- Field support trailers (i.e., WMF-645, WMF-646, WMF-657)
- Radiation Control Field Office (WMF-601)
- RWMC highbay (WMF-602)
- Advanced Mixed Waste Treatment Facility.
- Significant physical interfaces with RWMC systems include connection to the RWMC firewater supply, alarm, and electrical power systems.

1.8 Project Key Facility Components

Operational aspects of the OU 7-10 Project are described in the following sections. Each activity associated with OU 7-10 Project operations will incorporate hazard identification and mitigation measures and follow requirements of MCP-3562, "Hazard Identification, Analysis and Control of Operational Hazards," or Standard (STD) -101, "Integrated Work Control Process."

1.8.1 Weather Enclosure Structure

The WMF-671 WES is a commercially available enclosure measuring approximately 80 × 110 × 35 ft and is attached to the Facility Floor Structure. Figure 1-5 shows the WMF-671 WES facility layout. Operating personnel work within the WMF-671 WES during excavation and packaging operations. The WMF-671 WES consists of a prefabricated steel frame with an insulated membrane cover. The membrane is impregnated with flame resisting compounds. Although not considered equivalent to the fire-resistive characteristics of noncombustible materials, the WMF-671 WES achieves the fire protection objectives of the National Fire Protection Association (NFPA) 801, "Standard for Fire Protection for Facilities Handling Radioactive Materials," (NFPA 1998) with no reliance on the fire resistive characteristics of its construction. Thus, it is concluded that this construction method is appropriate for the WMF-671 WES. DOE-ID has agreed with this design decision.[b]

The WMF-671 WES provides vital support functions such as operational lighting, localized radiant heating, life safety systems, fire detection and suppression, ventilation, and filtration of the exhaust air. Fire protection for the WMF-671 WES is provided by an automatic dry-pipe sprinkler system plus detection and alarm systems.

For protection of the RCS and PGS, which are designated safety-significant, the WMF-671 WES is designed to meet performance criterion (PC) -2 wind-loading criteria identified in DOE-ID "Architectural Engineering Standards" (DOE-ID 2001). Meeting this criterion is bounding for seismic events. The WMF-671 WES also is designed with a structural framing to resist loading from snow, rain, and other weather-imposed loads. Lightning protection is provided on the outside of the WMF-671 WES and is designed to protect the facilities and personnel from the effects of a lightning strike.

1.8.2 Retrieval Confinement Structure

The RCS is a Nuclear Fuel Services, Inc.-Radiation Protection Systems, Inc. Perma-Con system manufactured by Kelly Klosure Systems interfaced with the excavator, FFS, and PGS. The Perma-Con

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b. Jerry L. Lyle, DOE-ID, Memorandum to Mark W. Frei, INEEL, "Fire Protection Equivalency Request for OU 7-10 Glovebox Excavator Method," January 10, 2002, DOE-ID-FPEQ-02-10.

system is a commercially available radiological confinement system constructed of stainless steel modular panels that lock together. Cross-members are provided within the panels to provide support for the steel panels. The structure is connected to the FFS and the three gloveboxes that makeup the PGS. Joints in the RCS are sealed with sealant and tape.

The RCS interface to the excavator is through inner and outer booted confinement assemblies. The inner boot assembly seals the boom pivot cylinder area and hydraulic hose opening area in the excavator frame. The outer assembly seals the excavator frame to the RCS. The inner assembly is a steel plate box constructed around the boom pivot cylinders and hydraulic hose opening. The inner assembly includes bulkhead fittings that interface to hydraulic hoses and an opening with a bolted steel plate to allow access to both sides of the bulkhead fittings. To seal the hydraulic hose opening, steel plates with hydraulic hose bulkhead fittings are welded to the excavator frame and boom pivot box. The outer booted confinement assembly is flexible to ensure seal integrity against small excavator movements and vibration, provides a barrier that shields the internal seal assembly from direct flame impingement, and is resistant to attack by waste zone materials. The outer boot consists of steel sheet welded to the outer excavator frame, steel angle, flat gasket material, Unistrut, fire shield, and commercial bulkhead connectors (see Figure 1-6).

The RCS viewing windows are made of Lexan. The viewing window in front of the operator's cab provides line of sight to portions of the excavation and the inside of the RCS. Lexan windows are combustible. By DOE-ID approval of an equivalency request, the use of Lexan windows in the RCS is appropriate for the project.[c]

Closed-circuit television cameras located in the roof of the RCS and connected to a video monitor in the operator's cab provide views of the excavation that cannot be seen through the window. Lights located on the RCS aid in visibility.

Access to and exit from the RCS is through a stainless steel panel door located in the personnel access room or through the personnel emergency transfer vestibule near the exhaust HEPA filter bank. Gloveports and transfer ports are located in some RCS panels to allow equipment or material transfer and manual manipulation without entering the RCS. Equipment and material enters and exits the RCS through stainless steel panel double doors in the transfer vestibule. The access doors are self-sealing.

Cable, pipe, hose, and other penetrations through the RCS are sealed by a variety of methods to ensure there are no leaks to the WMF-671 WES or the personnel and transfer vestibules. Several of the penetrations allow a radiological control technician (RCT) to insert a probed instrument into the RCS for the purpose of performing air monitoring.

The passive confinement features of the RCS are safety-significant and are designed to meet PC-2 seismic-performance criteria identified in DOE-ID "Architectural Engineering Standards." The WMF-671 WES is designed for PC-2 wind performance criteria and protects the RCS from this and other events.

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c. Jerry L. Lyle, DOE-ID, Memorandum to Miriam Taylor, INEEL, "Path Foreward for 10 CFR 830 Rule Requirements for Transportation at the INEEL," January 15, 2002, EM-AM-02-001.

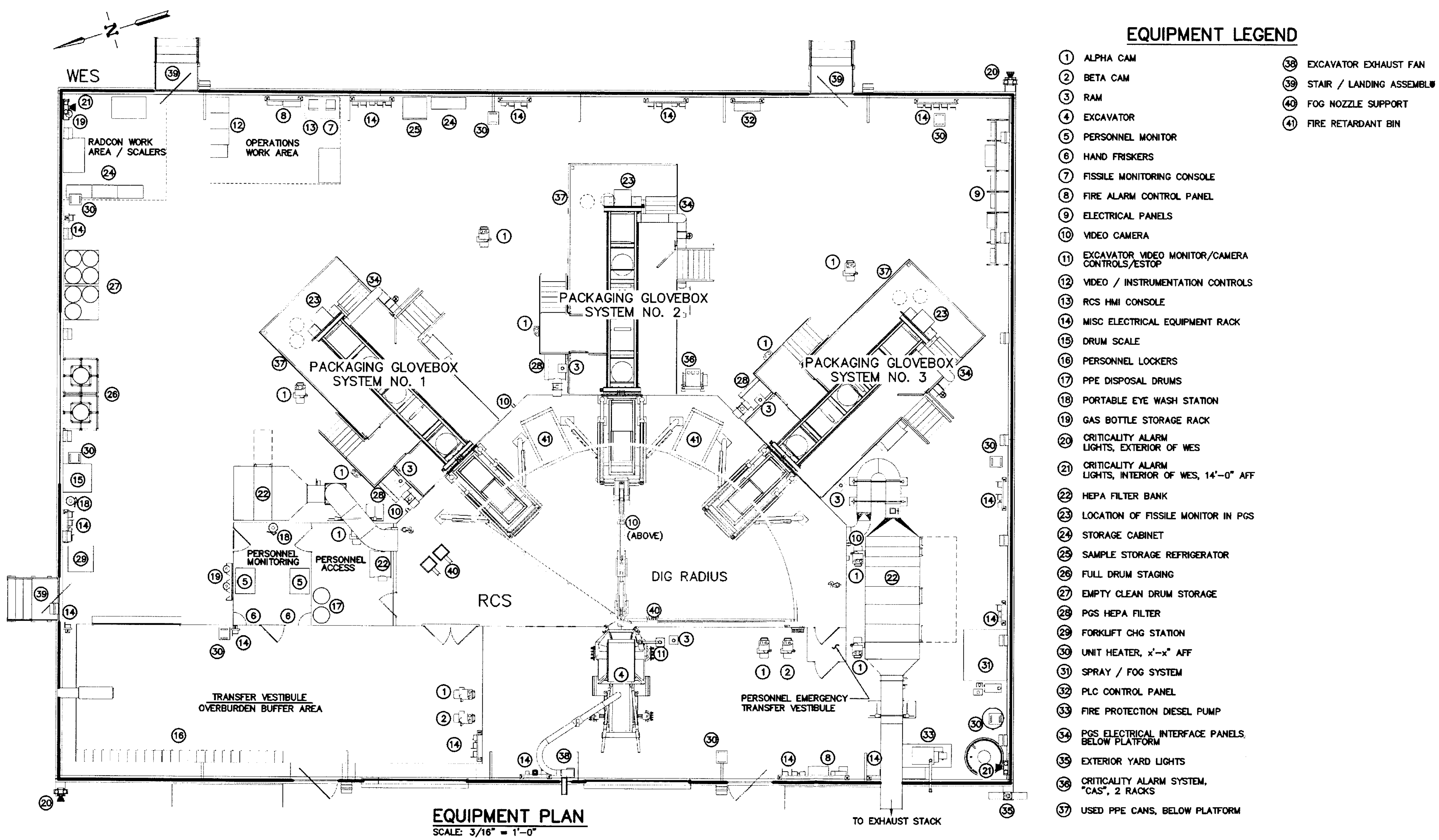

Figure 1-5. Drawing showing layout of individual gloveboxes for the Operable Unit 7-10 Glovebox Excavator Method Project inside Waste Management Facility-671 Weather Enclosure Structure.

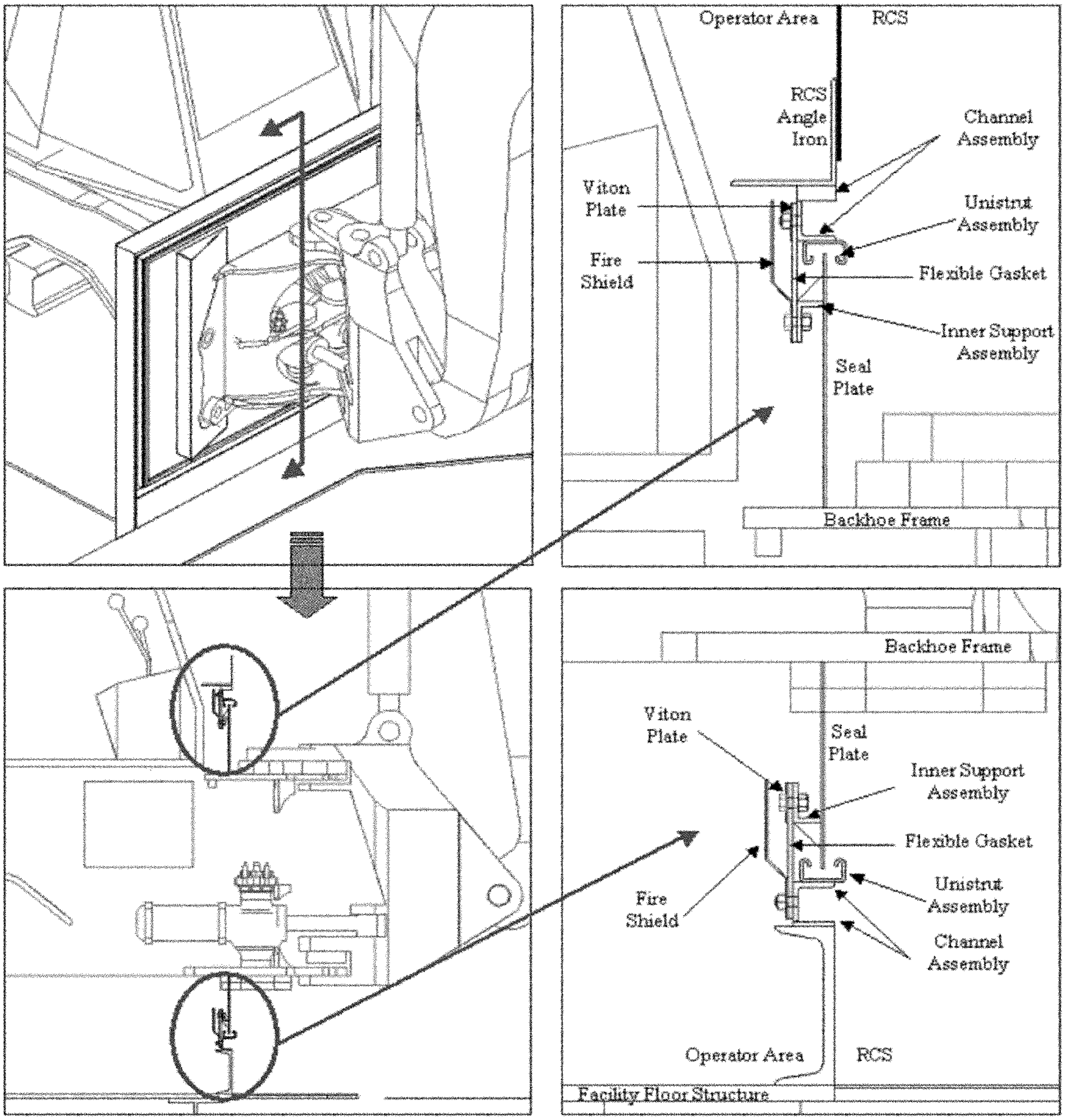

Figure 1-6. External excavator to the Retrieval Confinement Structure boot assembly.

1.8.3 Excavator

The excavator is a commercially available diesel engine backhoe loader that has been modified for the OU 7-10 Project to ensure contamination control and a stable confinement interface with the RCS. The tires, front-end loader bucket, bucket hydraulic cylinders, and outriggers are removed and the chassis is anchored to the FFS to prevent inadvertent motion. Physical stops are installed on the excavator to prevent contact of the end effectors with the RCS and RCS gloveports. Caps are seal welded on the RCS side of the stabilizer support frames and the lower mounting pins on stabilizers are welded closed to prevent contamination migration. Modifications to the excavator to provide the interface to the RCS are shown in Figure 1-6.

The excavator is controlled from inside the operator's cab, which is located at a window position outside the RCS to provide line-of-sight operations. Only the excavator arm extends into the RCS. The arm consists of a fixed-length boom, an extendable stick, and an end effector coupling controlled by the operator in the cab. The excavator can lift and move loads from any boom and stick position in the pit. The video monitor in the operator's cab provides the operator with views of areas that cannot be seen in the line of sight. A fan and duct connected to the excavator engine exhaust pipe ventilates exhaust from the excavator to outside the WMF-671 WES.

The structures and attachments to the FFS that ensure the excavator is immobile are designed to meet PC-2 seismic-performance criteria identified in DOE-ID "Architectural Engineering Standards." This design feature ensures that the excavator does not pull away from the RCS during a seismic event.

1.8.4 Packaging Glovebox System

The PGS consists of three rectangular gloveboxes attached in fan fashion to the RCS. The glovebox ends at the RCS are open and are sealed to the RCS. A structural steel framework that is anchored to the FFS supports each glovebox. The panels, penetrations, interfaces, and ports are sealed and secured to the frame or panels to ensure confinement. The assemblies are suitable for the waste zone materials.

The side panels consist of lower sections and one upper section. The lower panels are a laminate of chemically hardened glass on the outsides of Lexan. The upper panels and ceiling are a laminated safety glass material. This combination of composite panels at the bottom and laminated safety glass panels at the top and ceiling provides for a noncombustible structure that is capable of maintaining confinement during impact stresses. The floor and one end of each glovebox are constructed of stainless steel panels connected to a steel framework. A laminated safety glass window is located in the end steel panel of each glovebox. Each glovebox has an inlet HEPA filter, manual damper, and inlet filter ducting.

The gloves are suitable for the waste zone materials. For some operations, an outer leather glove is placed over the inner glove to provide protection from glove punctures and cuts.

Rail-mounted primary and auxiliary steel transfer carts service each glovebox. The glovebox operators manually position the auxiliary carts. The primary transfer carts are motor controlled, and limit switches control the range of movement. Cabling for the limit switches is through bulkhead fittings in the gloveboxes. The primary cart motors are located outside the gloveboxes. Light beam sensors within each glovebox prevent movement of the primary transfer cart when gloves are detected in the glovebox through the oval ports. The primary transfer carts are about 7 in. (17.78 cm) deep, and each is capable of transporting about 3 ft^3 of loose material or one intact drum.

Each glovebox has a rail-mounted electric chain hoist. For the purposes of inspection and maintenance of the hoists and rigging in the gloveboxes, the gloveboxes meet the definition of a hostile environment as defined by the DOE hoisting and rigging standard (DOE-STD-1090-01).

Each transfer cart is fitted with a custom-made liner. For lifting purposes, webbing is sewn to the underside of the liner with lift loops at the four corners. To lift a load out of the cart, the four lift loops are grouped together on the hoist hook.

Three drum loadout stations are included in each glovebox system. Each drum loadout station is accessed through a cover in the bottom of the glovebox. A funnel leads from each loadout station into the drum loadout enclosure. Clean drum transfer bags are used to maintain a contamination barrier between the glovebox and the drum loadout enclosure during drum loadouts. A drum liner is placed in the transfer bag and then the liner-bag assembly is placed in the drum. The open end of the bag is secured to the drum bag-out ring.

The passive confinement features of the PGS are safety-significant and are designed to meet PC-2 seismic-performance criteria identified in DOE-ID "Architectural Engineering Standards." The WMF-671 WES is designed for PC-2 wind performance criteria and protects the PGS from this and other natural events.

1.8.5 Drum Loadout Enclosures

During drum loadouts, the bag-out ring and new drum transfer bags form the primary confinement for the loadout area. A drum loadout enclosure is located under each glovebox and forms a contamination control barrier. The enclosures are constructed of fire resistant fabric panels on all sides with clear polyvinyl chloride windows, sleeves, and zippered molded plastic doors and are supported by grommets in the panels and ties to steel pipe frames. Interfaces are to the glovebox bag-out rings, the Facility Floor Structure, and the filters and ductwork leading to the RCS. Untestable inlet HEPA filters are located on each enclosure. The enclosure exhaust connects to the RCS by ductwork, a manually controlled damper, a testable HEPA filter, and another manually controlled damper. Lift tables located in the loadout enclosures position and support drums during drum packaging.

1.8.6 Personnel Monitoring, Personnel Access, and Transfer Vestibules

The personnel monitoring, personnel access, and transfer vestibules are Kelly Klosures Perma-Con System type structures similar to the RCS. The personnel monitor vestibule contains monitoring equipment for controlling exits from the personnel access and transfer vestibules. The personnel access vestibule accommodates the donning and doffing of personal protective equipment (PPE) for access and egress from the RCS personnel access door. The transfer vestibule provides a transition between the outside of the WMF-671 WES and the interior process and personnel work areas. Full and empty drums, soil bags, transfer equipment, and personnel can move in and out of the transfer vestibule. Equipment doors allow access to the RCS from the transfer vestibule.

1.8.6.1 Facility Floor Structure. The FFS design includes the framing and flooring for the weather enclosure floor and the shoring box through the overburden. The floor structure covers about the same area as the WMF-671 WES. The FFS is designed to support and interface to the WMF-671 WES, RCS, PGS, excavator, and other structures and equipment within the WMF-671 WES.

The main framing consists of structural steel, wide-flange shapes. The wide flanges rest on the ground surface and are designed to span at least 24 ft between support locations to provide support if a pit subsidence occurs. The floor is metal decking topped with a plate that has a nonskid surface. Areas with high loads, such as the excavator support area, use a plate that is thicker than in other areas of the WMF-671 WES.

The floor is the working surface for personnel and supports small forklifts, pallet trucks, and other movable equipment and instrumentation. Design loads include personnel, equipment, other structures, wind, and earthquake.

The shoring box is a steel structure similar in design to trench boxes commonly used for construction excavation, the main differences being the shape and size of the box. The box provides the perimeter for the arc-shaped excavation area. The box is made from structural steel tubing and steel plate and forms walls 3.5 ft down into the overburden. Excavation deeper than the shoring box establishes an angle of repose to eliminate large sloughing events that could undermine the FFS. Installation involved excavation of a 3.5-ft-deep trench around the perimeter of the retrieval area, installation of the metal shoring box in the trench, and backfilling the trench.

No reliance is placed on the FFS for the control of contaminated firewater. Any contaminated water that escapes the excavation area or other portions of the WMF-671 WES will be confined to the OU 7-10 surfaces external to the WMF-671 WES and the storm water catch basin located to the south of OU 7-10. By DOE-ID approval of an equivalency request, this contamination control method is considered appropriate for the OU 7-10 Project (see Footnote B).

The FFS within the RSC is safety-significant and is designed to meet PC-2 seismic-performance criteria identified in DOE-ID "Architectural Engineering Standards." The WMF-671 WES is designed for PC-2 wind performance criteria and protects the FFS from this hazard.

1.8.7 Interim Storage Pad

The interim storage pad is an open gravel pad used for the interim storage of waste coming from the PGS. Onsite storage will be required pending a decision on final disposition or shipment to the INEEL CERCLA Disposal Facility (ICDF). An optional staging area that may be used is the overburden staging area.

Toxic Substances Control Act (15 USC § 2601 et seq., 1976) and RCRA cargo containers may be used for interim storage of Toxic Substances Control Act and RCRA waste coming from the PGS. Onsite storage or possibly WMF-628 will be required pending a decision on final disposition or shipment to the ICDF.

1.8.8 Comprehensive Environmental Response, Compensation, and Liability Act—Compliant Storage

Onsite storage of newly packaged waste materials may occur adjacent to the WMF-671 WES or in WMF-628. The WMF-628 is a RCRA-permitted storage building at the RWMC. Storage in WMF-628 is addressed in the main body of the RWMC safety analysis report.

1.8.9 Overburden Staging Area

The overburden staging area is an open gravel pad located outside of the OU 7-10 boundary used to stage the bagged overburden soil until pit closure activities or optional transfer to ICDF or other acceptable disposal locations. The overburden staging area also may be used to stage waste containers after packaging.

1.8.10 Fire Riser Building

The fire riser building is a small heated, metal structure with a concrete floor. This structure contains the fire riser tie-in to RWMC services that supply the fire suppression systems for the WMF-671 WES and RCS and an air compressor for maintaining air pressure in the dry-pipe systems.

1.8.11 Radioassay Facility

Drums containing newly packaged waste zone materials are assayed before storage to ensure that the fissile material loading is ≤380 g fissile gram equivalent (FGE). The project has opted to use a commercially available trailer-mounted assay system. The trailer system would be located near the project interim storage pad. The trailer is equipped with an office and the detection unit.

1.8.12 Radiological Control and Security Trailer

The Radiological Control and Security Trailer is a commercially available structure set up at the project site. The trailer will contain essential radiological control equipment, such as portable self-monitoring instruments, portable radiation detection instruments, and contamination count-rate instruments. The trailer also will have a small portable glovebox counting potentially highly contaminated swipes from the RCS and PGS. The glovebox is needed for contamination control while performing the smear counts. The glovebox is ventilated with a HEPA filtration system, is constructed of stainless steel and Lexan, has a french can transfer port, and has a standard bag-in bag-out transfer port. All waste generated in the swipe counting glovebox will be returned to the PGS by way of the french can system.

1.9 Project Operations and Processes

This subsection describes the activities and decisions relating to the OU 7-10 Project waste-material retrieval and handling process. It is expected that retrieval and packaging can be accomplished over a period of less than 3 months. The facilities then will be placed in a shutdown and lay-up condition and deactivation, decontamination, and decommissioning (D&D&D) will be performed.

1.9.1 Overburden Removal

The overburden is removed from within the shoring box by the excavator working through the RCS wall and workers working inside the RCS. Steel and Lexan probes were inserted to various depths in the excavation area during Stage I of the OU 7-10 Project. Workers with hand tools are required for overburden removal around some of these probes. Monitoring will be performed in the RCS and workers in the RCS will wear PPE as required by the RCT, the safety professional, and the industrial hygienist (IH). The dust suppression system or hand operated portable spray units are used to keep the dust down and reduce the potential for contamination spread.

Excavated soils are placed in commercially available soil sacks. Before removal from the RCS, the soil sacks are closed by workers and are monitored by an RCT for contamination. After monitoring and decontamination, if required, the soil sacks are moved by material handling equipment from the RCS to the transfer vestibule where they are checked again for contamination. The sacks may be staged in the transfer vestibule pending movement to the overburden staging area pending disposal or reuse in the excavation.

1.9.2 Waste Zone Material Removal

The waste zone material, which includes interstitial soils, waste materials, and container remnants, is excavated by the excavator. The excavator operator maintains an angle of repose on the sides of the excavation to ensure that large sloughing events do not occur. Operators outside the RCS activate the dust-suppression system (DSS) as needed to control airborne dust. The DSS in conjunction with the ventilation system ensures that airborne contamination levels are controlled.

By design, the RCS and PGS are passive confinement systems. That is, on a loss of ventilation, contamination spread into the WMF-671 WES is not expected. However, as a precaution during loss of ventilation events, the excavator operator will return the controls to their neutral conditions, turn off the excavator engine, and leave the area with the glovebox operators and others in the WMF-671 WES. These precautions ensure that the excavator does not become a potential source of contamination spread outside the WMF-671 WES through the engine and exhaust, that the excavator air intake does not produce a negative pressure condition in the WMF-671 WES relative to the RCS and PGS, and that the operators in the WMF-671 WES do not become potential exposure targets during a loss of ventilation. Personnel will be allowed back in the WMF-671 WES when ventilation is restored and a reentry survey by the RCT indicates it is safe with concurrence from the industrial hygienist. The RCT is directed by company procedures that specifically address loss of contamination incidents if a loss of contamination occurs. These precautions ensure that the excavator does not become a potential source of contamination spread outside the WMF-671 WES through the engine and exhaust, that the excavator air intake does not produce a negative pressure condition in the WMF-671 WES relative to the RCS and PGS, and that the operators in the WMF-671 WES are not potential exposure targets during a loss of ventilation.

Refueling of the excavator is from a portable fuel container that is brought into the WMF-671 WES. Fuel is transferred from the container to the fuel tank. The container is then removed from the WMF-671 WES. Drip pans are installed beneath the fuel tank and hydraulic reservoir to contain spilled or leaking fluids.

The dominant waste forms that will be encountered in the waste zone have been assessed based on an evaluation of shipping records for waste placed in a 12.2 × 12.2-m (40 × 40-ft) area, also referred to as the Stage I area, around and near the smaller excavation area addressed by this safety analysis. The results of this assessment are shown in RWT-01-99.[d] The dominant waste form is drums of Series 743 sludge[e] containing organics such as cutting oils and carbon tetrachloride (CCl_4). The next significant types of waste are drums containing contaminated combustible materials. Of lesser number are drums of evaporated salts (nitrates) and drums of graphite material (believed to be crushed molds).

The project is not required to remove all materials from the waste zone. Some of the steel and Lexan probes inserted during Stage I are relocated with the excavator and placed in other areas of the excavation. Unexpected materials such as compressed gas cylinders, containers of nonradiological materials that are pyrophoric (such as zirconium), laboratory generated waste (i.e., multiple containers of lab waste consolidated in a drum), and containerized unknowns may be left in place. Before removal from the excavation, a nonsparking tool attached to the excavator will puncture intact drums. The weight of waste zone materials is expected to be well within the handling limits of the excavator. Unexpected materials that could exceed the excavator design handling weight of 1,000 lb (454 kg) and that cannot be sized with the excavator to less than 1,000 lb (454 kg) are not removed from the excavation. Intact drums that may exceed the glovebox design basis drop weight of 350 lb (159 kg) and that cannot be sized with the excavator to less than 350 lb (159 kg) are not processed through the gloveboxes. Materials weighing less than these design-basis weights but that cannot be sized to fit in a 55- or 85-gal drum are not processed through the gloveboxes. The excavator operator, using readings from a pressure indicator, checks the weight of materials during lifts. Sizing of materials can take place in a drum-sizing tray when needed. The design dimensions of the drum-sizing tray prevent the accumulation of free liquids to a depth greater than 8 in. (approximately 10 L). The 2.6-gal limit is based on the criticality safety evaluation.

To ensure adequate radiation protection of the glovebox operators, each bucket and cart of waste zone material is monitored by an RCT located outside the confinement. Temporary shielding or special handling procedures may be required for waste zone materials with high radiation readings or the material may be returned to the excavation.

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d. W. Thomas Roderick, INEEL, Interdepartmental Communication to David E. Wilkins, INEEL, "Waste Contents Associated with OU 7-10 Stages I/II Activities in Pit 9," April 16, 1999.

e. The waste is called Series 743 sludge because it was processed into sludge in the Rocky Flats Plant (RFP) Building 774 and was later coded at the Idaho National Engineering and Environmental Laboratory (INEEL) as Content Code 3 organic waste to distinguish it from other types of waste from RFP Building 774 that were shipped to the INEEL.

Lead shielding material or aerosol cans are not expected in the excavation area but may be encountered. These materials present an insignificant hazard and can be safely excavated and handled through the RCS and PGS.

After monitoring by the RCT, the excavator operator empties the bucket of waste zone materials in a transfer cart. The transfer cart is moved on rails by a drive system controlled by a glovebox operator.

If more than 2.6 gal (10 L) of free liquids (i.e., liquids that are visible and uncontained) at a liquid depth greater than 2.6 in. are observed in the retrieval area, operations in that area temporarily stop until an absorbent is added to the liquid. Operations can continue once the absorbent is added. The absorbent is a commercially available product that has been prestaged within the RCS. The excavator is used to apply the absorbent when needed. If simple absorption will not be effective based on the liquid observed or if absorption is not effective, work will stop and special-case handling procedures will be developed.

1.9.3 Packaging Glovebox System Operation

Glovebox system operation consists of monitoring and visual screening of waste, waste zone material sampling, packaging waste zone material, and sampling the underburden soils. Each of these is discussed in the following sections.

1.9.3.1 Monitoring and Visual Screening. Each cart of waste zone material is surveyed by an RCT. Temporary shielding or special handling procedures may be required for waste zone materials with high radiation readings or the material may be returned to the excavation. Monitoring and visual screening of waste zone materials are performed in the PGS by the glovebox operators. Hand tools are used by the operators to investigate the waste zone material to identify materials requiring special handling, to ensure that the receiving Treatment, Storage, and Disposal Facility (TSDF) waste acceptance criteria (WAC) is met, and to identify unexpected materials that may require special handling procedures or additional safety analysis. There could be small amounts of polychlorinated biphenyls (PCBs) in some sludge. Waste material contaminated with PCBs is prohibited by the receiving TSDF WAC. Drums of PCB-contaminated waste zone material will require storage in cargo containers located near the WMF-671 WES until final disposition is determined. Each PGS is equipped with a fissile material monitor (FMM), which contains an Eu-152 radioactive source. The sources are contained inside the FMM during normal operations. Source-handling processes (i.e., source installation and removal) require special radiological controls that will be implemented through a radiological work permit (RWP). Some waste types will require fissile monitoring to ensure the receiving TSDF WAC of 200 g fissile material is met while others will not (Sentieri 2003). Waste types requiring fissile monitoring are listed below:

- Intact HEPA filters.
- High-efficiency particulate air filter media.
- Material not distinguishable from HEPA filter media.
- Intact graphite molds and large chunks of graphite molds (i.e., pieces greater than 2 in. in diameter).
- Other containerized unknown waste materials with the potential of having unsafe plutonium masses.

These waste types may not undergo fissile monitoring if new data become available that indicate that the actual drum loadings are less than 200 g.

The materials to be monitored will be placed in a specimen container. The volume of the FMM specimen container is limited to no more than 5.5 gal. This container is then placed into the shielded monitoring station. The detectors are mounted outside the gloveboxes. Fissile monitoring is accomplished through a window.

Waste types not requiring fissile monitoring are as follows:

- Sludge
- Soils
- Drum remnants
- Personal protective equipment
- Plastic materials used in contamination control
- Materials that through process knowledge are known to not contain high concentrations of fissile material.

1.9.3.2 Waste Zone Material Sampling. The details about sample data quality objectives, sample location and frequency, sample designation, sampling equipment and procedures, sample handling and analysis, and sample waste management are found in the *Field Sampling Plan for the OU 7-10 Glovebox Excavator Method Project* (Salomon et al. 2003). The purpose of sampling is to characterize a portion of the retrieved waste zone material to satisfy the receiving TSDF WAC and to support safe and compliant storage. During retrieval activities, rudimentary classification of the waste zone materials is conducted. This classification will classify waste zone materials as soils and gravel and debris waste. It is expected that the predominant waste stream will be soils and gravel. The soils and gravel are considered a single waste stream and will be sampled by way of a composite sampling scheme wherein the contents of every drum will be represented. Within the soil and gravel designation, there are three subpopulations. The first is a possible nitrate bearing waste that will be sampled and undergo analysis to determine if it is reactive or ignitable (i.e., oxidizer) in accordance with RCRA. Visual screening will be used to identify suspect nitrate concentrations that require biased sampling of the waste zone material. The second is uncontainerized liquids that will be analyzed for PCBs. The third is pellets potentially containing cyanides (potassium or sodium cyanide). Physical samples of debris waste are not required.

Samples not described by the *Field Sampling Plan* may be required (Salomon et al. 2003). If warranted by the situation, additional samples may be collected using the framework of the field sample plan. Authorization to proceed with the collection and analysis of unplanned samples will be determined by management.

Samples are collected in sample containers located within the PGS. The sample container is passed through the transfer port into a french can. The french can is a commercially available double door transfer system that ensures confinement of contamination on the sample containers. The french cans may be temporarily stored in a refrigerator located in the WMF-671 WES until they can be transported onsite to Idaho Nuclear Technology and Engineering Center at the INEEL for analysis. A transport plan is prepared for the shipments. The transport plans and the DOE-ID Transportation Safety Document ensure compliance with the safety analysis requirements of 10 CFR 830 Subpart B for transportation (see Footnote C). The residual sample materials are returned in a french can and removed from the can at a transfer port in the PGS. The residual sample materials are placed in new waste drums along with other waste zone materials during the waste zone material packaging process.

1.9.3.3 Packaging Waste Zone Material.
Most of the packaging is in 55- or 85-gal drums. Sealable bags, referred to as special case bags, may be used to contain items such as bottles of liquid or other unexpected items. When necessary, the waste zone materials are sized in the glovebox using hand tools. Hold down straps can be attached to the transfer cart to secure waste zone materials during sizing if needed to ensure worker safety. A new drum liner is placed inside the drum transfer bag and the liner and bag assembly is placed in the new drum. The drum is positioned in the drum loadout enclosure on a lift table under a drum loadout port. The drum is raised on the lift table to under the drum loadout port. The open end of the transfer bag is secured to the loadout port with the bag-out ring. The glovebox operator removes the drum loadout cover in the glovebox and moves waste materials through the loadout port. The loadout port cover is closed, and the transfer bag is closed and becomes a part of the waste stream. The drum lid with filtered vents previously installed is secured, and the drums are surveyed while in the drum loadout enclosure. Drums are moved to a staging area within the WMF-671 WES or to the interim storage pad, pending assaying. The WMF-671 WES staging area is located spatially away from the excavator and fueling equipment as a fire protection feature.

Fissile monitoring does not constitute an assay. Drums that have been assayed and confirmed to meet the storage WAC can be safely stored in any configuration.

The newly packaged waste drums have bar code labels. These labels are recorded, and the bar code label identification number is recorded along with a description of the container contents. The weight of the container may be recorded in an operational log.

Drums can be returned for repackaging if the assay results indicate the container is greater than 200 g FGE but ≤ 380 g FGE. Repackaging involves placing the drum in an 85-gal drum, attaching the drum using the transfer bag and bag-out ring, and using the hoist to pull the overloaded drum into the glovebox for repackaging or removing by hand or the hoist individual liners or bags from the drum. If any new drum contains more than 380 g (13.4 oz) FGE, the drum will be handled in accordance with the applicable technical safety requirements.

1.9.3.4 Sampling the Underburden.
A collection device attached to the excavator arm is used to gather core samples of the underburden. The samples are placed in containers in the RCS or PGS and then passed through transfer ports.

The details regarding sample data quality objects, sample location and frequency, sample designation, sampling equipment and procedures, sample handling and analysis, and sample waste management are found in the *Field Sampling Plan* (Salomon et al. 2003). The objectives of the underburden sampling are to determine the presence and migration of the contaminants of concern as documented in the 1993 OU 7-10 ROD (DOE-ID 1993). Visual examinations will be performed of the excavation bottom to identify underburden sample locations.

1.9.4 Postretrieval and Packaging Operations

Operations after underburden sampling are characterized as post retrieval and packaging. These operations are discussed in the following sections.

1.9.4.1 Facility Shutdown.
At the conclusion of waste retrieval and underburden sampling operations, the OU 7-10 Project will perform facility shutdown activities to place the excavation and facility into a safe, known, and stable condition where it will remain in lay-up until D&D&D operations begin. Figure 1-7 shows the four major functions associated with facility shutdown.

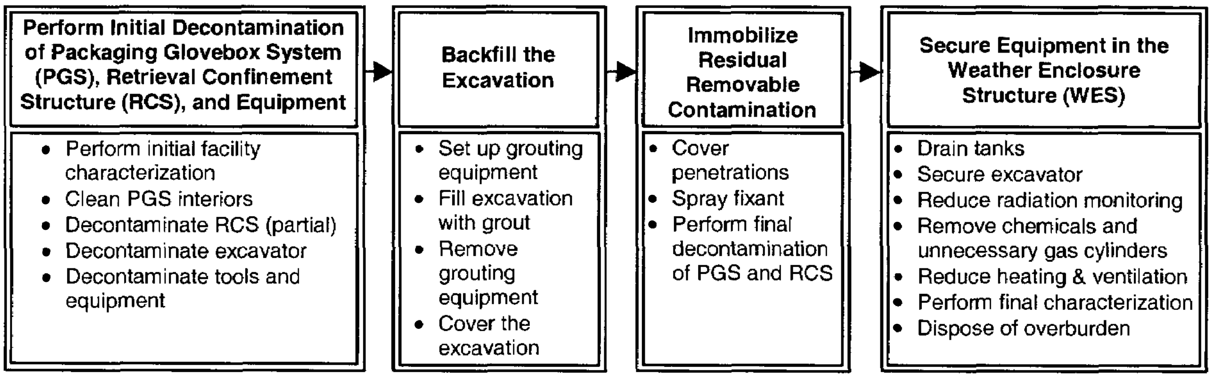

Figure 1-7. Four major functions associated with the Operable Unit 7-10 Glovebox Excavator Method Project facility shutdown process.

A summary of conditions expected after facility shutdown and to be monitored and maintained during the lay-up period is listed below:

- **Stage I investigation probes:** The radiological contamination on exposed surfaces of any remaining vertical probes has been immobilized. The probes that were pulled during excavation have been laid on the sides of the excavation area and covered by grout. All probes are closed on both ends and are empty inside.

- **Pit and shoring box:** The pit has been filled with a weak grout. Remaining contamination on the exposed portions of the shoring box is immobilized.

- **Equipment inside the RCS and the PGS:** Waste, grease, and loose dirt have been removed from the larger equipment inside the RCS and PGS and the equipment pieces are wrapped in plastic. Tools and other small items have been bagged out of the RCS and PGS for disposal.

- **Contamination on inside surfaces of RCS and the PGS glovebox skins:** All waste zone material has been removed from surfaces of the RCS and PGS. Gloves have been removed and gloveports and sample ports have been covered and sealed. The windows of the RCS and PGS have been decontaminated and left uncovered. The remaining surfaces are covered in strippable paint.

- **Heating and ventilation systems:** The heating and ventilation systems are left operating, but airflow may be reduced on the ventilation system. Airflow and negative differential pressure levels will be determined based on actual facility conditions by RadCon personnel to ensure continued confinement of radioactive contamination.

- **Fire detection and suppression systems:** The dry-pipe fire detection and suppression system in the RCS is operational. The RCS deluge, RCS carbon monoxide monitoring, and PGS fire suppression systems have been removed from service.

- **Excavator:** The excavator has been left operable and in place. Grease, loose dirt, and loose waste have been removed from the excavator arm and the arm will be in a resting position. The arm has been coated with strippable paint and wrapped in plastic sheeting. Any leaking hydraulic fluid found from the excavator outside of the RCS has been cleaned, monitored for radiation, and the leaking area covered with clear plastic. The hydraulic system has been flushed, the fuel has been drained, and the battery disconnected.

- **Compressed air tanks:** The breathing air and plant air receiver tanks have been depressurized.

- **Water tanks:** Water has been removed from the DSS and the PGS fire suppression system. The tanks are expected to be free of contamination. The valves at the RCS wall have been shut to close the potential path for contamination to the piping and water tanks.

- **Radiological monitoring:** Constant air monitors (CAMs), RAMs, personal contamination monitors (PCMs), and hand friskers remain operational although possibly reduced in number. The glovebox FMMs and the criticality alarm system have been removed from service.

- **Weather enclosure structure equipment:** All other equipment in the WMF-671 WES has been left in place but may be unplugged from power.

- **Overburden:** Sacks of overburden from retrieval operations have been sent to the ICDF or RWMC low-level waste pit or will have been used in overburden replacement.

- **Portable support equipment:** Most of the portable support equipment trailers remain in place at the OU 7-10 Project site to support D&D&D operations.

- **Assay trailer:** If used, the assay trailer is disconnected and removed from the site.

1.9.4.2 Facility Lay-Up Phase. The facility lay-up phase immediately follows facility shutdown. The duration of this phase will be kept to a minimum by initiating preparations for D&D&D in parallel with other activities. However, the facility has been designed such that this phase could be safely maintained for up to 1 year. The scope of activities performed within the facility during the lay-up phase includes surveillances, monitoring, and facility and equipment maintenance. Examples include routine RadCon surveillances to ensure continued confinement and control of radioactive contamination, monitoring of radiation and airborne contamination, monitoring of environmental emissions, and periodic maintenance of active and deactivated equipment. Preparations for the D&D&D phase are initiated.

The facility is expected to be in the same condition just before D&D&D as the facility lay-up phase. Should an unexpected radiological condition or equipment failure have occurred during lay-up, additional decontamination or equipment maintenance may have been performed.

1.9.4.3 Facility Deactivation, Decontamination, and Dismantlement Phase. The facility D&D&D phase will primarily involve deactivation and dismantlement of the OU 7-10 Project facility with site restoration of the OU 7-10 surface and associated OU 7-10 Project work areas. Debris treatment, excess equipment disposition, material transportation, and waste disposal also will be performed during the D&D&D phase.

Before D&D&D, the OU 7-10 Project team will perform a walk-down of the facilities and equipment with OU 7-10 Project engineering and RadCon personnel to ensure familiarization of the physical configuration for the shutdown phase. Work orders will be prepared to remove lockout and tagout (LO/TO) locks tags from equipment that will be used during the D&D&D phase.

1.10 Program Interfaces

The OU 7-10 Project is being conducted under the regulatory authority of CERCLA, the OU 7-10 ROD (DOE-ID 1993), and the Explanation of Significant Differences to the OU 7-10 ROD (DOE-ID 1998).

This project operates as a facility under the purview of the RWMC operations director. Project operations will be conducted in accordance with the project addendum to the RWMC safety analysis report, this HASP, interface agreement(s), and project operating procedures (standard and detailed).

2. HAZARD IDENTIFICATION AND MITIGATION

The OU 7-10 Glovebox Excavator Method Project includes excavation, handling, sizing (when needed), and packaging of waste, samples, and soils. Materials within the waste zone are placed primarily in 55-gal drums and secondarily in 85-gal drums. Operation of the project facilities will present physical, chemical, and radiological hazards to operations personnel, so identification and mitigation of these hazards is imperative to prevent injury or exposure to personnel conducting these activities. The primary objective of this section is to identify existing and anticipated hazards based on project operations and to provide controls to eliminate or mitigate these hazards which includes the following:

- Evaluation of project operations to determine the extent that potential industrial safety, radiological, nonradiological, and physical hazards may affect facility personnel
- Establishment of the necessary monitoring and sampling required to evaluate exposure and contamination levels, determine action levels to prevent exposures, and provide specific actions to be followed if action levels are reached
- Determination of necessary engineering controls, isolation methods, administrative controls, work practices, and (where these measures will not adequately control hazards) PPE to further protect project personnel from hazards.

The purpose of this hazard identification section is to lead the user to an understanding of the occupational safety and health hazards associated with project operational tasks. This will enable project management and safety and health professionals to make effective and efficient decisions related to the equipment, processes, procedures, and the allocation of resources to protect the safety and health of project personnel.

The magnitude of danger presented by these hazards to personnel conducting project operations in the WMF-671 WES, RCS, and PGS is dependent on both the nature of tasks being performed and the proximity of personnel to the waste materials. Engineering controls have been implemented along with administrative controls, work procedures, and PPE to further mitigate potential exposures and hazards.

The following section describes the chemical, radiological, safety, and environmental hazards that personnel may encounter while conducting project operational activities. Hazard mitigation will be accomplished through a combination of designed engineering controls with other work controls (such as technical procedures, work orders, JSA, and Guide–6212, "Hazard Mitigation Guide for Integrated Work Control Process"). This hazard mitigation strategy will be used to eliminate or mitigate project hazards in accordance with Program Requirements Document (PRD) -25, "Activity Level Hazard Identification, Analysis, and Control," to the extent possible.

2.1 Chemical and Radiological Hazards and Mitigation

Personnel may be exposed to industrial safety hazards or to radiological, nonradiological, and physical agents while conducting project operations. Designed engineering controls will be implemented along with work procedures, real-time monitoring of contaminants, and project facility-specific hazard training to further mitigate potential hazards and exposures. Formal preplanning (e.g., job walk-down, completion of the hazard profile screening checklists, and prejob briefing checklists), JSAs, and other work controls will be written based on the hazards identified in this HASP, technical procedures, STD-101, "Integrated Work Control Process," work packages, and operational conditions. These documents will specify specific operational hazard mitigation measures to follow.

The dominant waste forms (see Table 2-1) that will be encountered in the waste zone have been assessed based on an evaluation of shipping records for waste placed in a 40 × 40-ft area, also referred to as the Stage I area, in and near the project excavation area. The results of this assessment are shown in Table 2-1 (see Footnote D). The dominant waste form for this area of OU 7-10 is drums of Series 743 sludge (see Footnote E) containing organics such as cutting oils and carbon tetrachloride. The next significant types of waste are drums containing contaminated combustible materials. Of lesser number are drums of evaporated salts (nitrates) and drums of graphite material (believed to be intact or crushed molds).

Table 2-1. Dominant waste forms in the Stage I (project excavation) area.

Waste Stream	Content Code	Summary Characteristics	Packaging	Estimated Quantity
Series 741 sludge first stage sludge	001	Salt precipitate containing plutonium and americium oxides, depleted uranium, metal oxides, and organic constituents.	40 to 50 lb of Portland cement added to bottom of drum and each of two (inner and outer plastic bags, and the top of the outer bags to absorb any free liquids. Lead sheeting may line inside of the drum as well	3 drums
Series 742 sludge second stage sludge	002	Salt plutonium and americium oxides, metal oxides, and organic constituents.	40 to 50 lb of Portland cement added in layers to absorb any free liquids. Waste is double-bagged and drummed.	27 drums
Series 743 sludge organic setups	003	Organic liquid waste solidified using calcium silicate (paste or greaselike).	30 gal of organic waste mixed with 100 lb calcium silicate. Small quantities (10 to 20 lb) of Oil-Dri added to top or bottom of drum, if necessary. Double-bagged.	379 drums
Series 744 sludge special setups	004	Complexing chemicals (liquids) including Versenes, organic acids and alcohols solidified with cement.	190 lb of Portland cement and 50 lb of magnesia cement in drum followed by the addition of 26.5 gal of liquid waste. Additional cement top and bottom. Double-bagged.	2 drums
Series 745 sludge evaporator salts	005	Salt residue from evaporated liquids from solar ponds containing 60% sodium nitrate, 30% potassium nitrate, and 10% miscellaneous.	Salt residue packaged in plastic bag and drum. Cement added to damp or wet salt, when necessary.	42 drums
Noncombustible waste	480	Various miscellaneous waste (e.g., gloveboxes, lathes, ducting, piping, angle iron, electronic instrumentation, pumps, motors, power tools, hand tools, chairs, desks).	Varies by process line generating the waste. Waste may have been wrapped in plastic or placed directly into the waste container.	28 drums
Combustible waste	330	Dry combustible materials (e.g., paper, rags, plastics, surgeons' gloves, cloth coveralls and booties, cardboard, wood, wood filter frames, polyethylene bottles).	Varies by process line generating the waste. Plastic bags used in some instances, but in other instances waste placed directly into waste container.	260 drums
Graphite	300	Graphite mold pieces after excess plutonium removal. Molds are broken into large pieces before packaging.	Drums lined with polyethylene bags and, most likely, a cardboard liner.	22 drums
Empty 55-gal drums	No code	Empty drums that originally held lathe coolant at Rocky Flats Plant. Some drums may contain residues.	Single drum placed in cardboard carton.	544 drums

Several tables are presented in this section that identify the potential hazards that may be encountered during project operations based on known waste inventory and operational activities, which state the associated monitoring methods and other hazard-specific mitigation measures. These tables are listed below:

- Table 2-2: Total activities for radiological contaminants in OU 7-10
- Table 2-3: Chemical inventory for OU 7-10 and the Stage I area
- Table 2-4: Evaluation of chemicals and potential agents that may be encountered
- Table 2-5: Summary of project operational activities, associated hazards, and mitigation.

2.1.1 Routes of Exposure

Exposure pathways exist for radiological and nonradiological contaminants that will be encountered during project operations. Engineering controls, monitoring, training, and work controls will mitigate potential contact and uptake of these hazards to a large extent; however, the potential for exposure still exists. Exposure pathways include those listed below:

- **Inhalation** of radiological and nonradiological contaminated soil or fugitive dusts during waste handling and sorting, packaging, or decontamination tasks. Inhalable or respirable (dependent on the particle aerodynamic diameter) fugitive dusts may have trace amounts of radiological or nonradiological contaminants associated with them, resulting in potential respiratory tract deposition.
- **Skin absorption and contact** with radiological and nonradiological contaminated soil or surfaces during waste handling and sorting, packaging, decontamination, or system maintenance tasks. Radiological and nonradiological contaminants can be absorbed through broken skin or by solvent action, resulting in uptake, and skin contamination or irritation.
- **Ingestion** of radiological and nonradiological contaminated soil or materials adsorbed to fugitive dust particles or waste residues, resulting in potential uptake of contaminants into the upper respiratory tract or directly into the through the gastrointestinal (GI) tract (placing contaminated surfaces in mouth) that may result in GI irritation, internal tissue irradiation, or deposition to target organs.
- **Injection** of radiological and nonradiological contaminated materials by breaking of the skin or migration through an existing wound, resulting in localized irritation, contamination, uptake of soluble contaminants, and deposition of insoluble contaminants.

Chemical and radiological hazards will be eliminated, isolated, or mitigated to the extent possible during all project operations. Where these hazards cannot be eliminated or isolated through engineering controls, monitoring for chemical and radiological hazards will be conducted (as described in Section 3) to detect and quantify exposures. Additionally, administrative controls, training, work procedures, and protective equipment will be used to further reduce the likelihood of exposure to these hazards through the routes of entry listed above. Table 2-5 summarizes each primary operational activity, associated hazards, and mitigation procedures.

The RWPs will be used and SWPs may be used in conjunction with this HASP to provide task- or activity-specific requirements for project operations. When used, these permits will further detail specialized PPE and dosimetry requirements.

Table 2-2. Total activities for radiological contaminants in Operable Unit 7-10 decayed to 34 years (1969–2003) using RadDecay.[a,b]

Radionuclide	Ci	Half-Life (Year)	34-Year Decay Activity (1969 to 2003) (Ci)
Am-241	3.2E+03	4.32E+02	3.5E+03
Ba-137m	5.8E-01	4.80E-05	2.5E-01
C-14	3.4E-04	5.73E+03	3.4E-04
Ce-144	4.2E-01	7.80E-01	0
Co-58	3.0E-03	1.94E-01	0
Co-60	1.2E+00	5.27E+00	1.4E-02
Cr-51	5.9E-01	7.59E-03	0
Cs-137	5.8E-01	3.02E+01	2.7E-01
Eu-154	8.8E-07	8.80E+00	6.0E-08
Eu-155	3.0E-03	2.73E+00	2.6E-05
Fe-55	1.1E+00	2.73E+00	5.0E-04
Mn-54	5.0E-03	8.57E-03	0
Nb-95	6.4E-02	9.75E-02	0
Ni-59	1.7E-04	7.60E+04	1.7E-04
Ni-63	1.3E-01	1.00E+02	1.0E-01
Pr-144	4.2E-01	3.30E-05	0
Pu-238	5.0E+01	8.77E+01	3.8E+01
Pu-239	1.7E+03	2.41E+04	1.7E+03
Pu-240	3.9E+02	6.56E+03	3.9E+02
Pu-241	1.1E+04	1.44E+01	2.1E+03
Pu-242	2.0E-02	3.75E+05	2.0E-02
Ru-106	2.1E-01	1.01E+00	0
Rh-106	2.1E-01	9.50E-07	0
Sb-125	9.1E-02	2.77E+00	1.8E-05
Sr-90	3.5E-01	2.86E+01	1.5E-01
Tc-99	5.5E-05	2.13E+05	5.5E-05
U-234	7.5E-01	2.46E+08	7.5E-01
U-235	5.3E-02	7.04E+08	5.3E-02
U-238	4.0E+00	4.47E+09	4.0E+00
Y-90	3.5E-01	1.20E-04	1.5E-01
Zr-95	6.4E-02	1.75E-02	0

a. (RadDecay)
b. (Einerson and Thomas 1999)

Table 2-3. Chemical inventory for Operable Unit 7-10 and the Stage I area.

Chemical	Content Code	OU 7-10 Inventory (g)	OU 7-10 Inventory (L)	Stage I Area (g)	Stage I Area (L)
Asbestos	335, 338, 490	4.0E+05	—	—	—
Ascorbic acid	004	1.4E+06	—	6.67E+04	—
Beryllium	001	5.8E+04	—	2.70E+02	—
Beryllium	002	1.9E+04	—	2.59E+03	—
Beryllium (total)	001, 002	7.7E+04	—	2.86E+03	—
Butyl alcohol	001, 002	1.1E+03	1.36E+00	5.25E+01	6.48E-02
Cadmium	001, 002	5.4E+02	—	2.58E+01	—
Carbon tetrachloride	001, 002, 003, 004	9.4E+07	1.54E+04	3.13E+07	5.13E+03
Chloroform	001, 002, 003, 004	1.6E+05	1.07E+02	3.49E+04	2.34E+01
EDTA (assumed to be tetrasodium)	004	1.4E+06	—	6.67E+04	—
Ethyl alcohol	004	1.1E+06	1.39E+03	5.24E+04	6.64E+01
Freon 113	003	8.5E+05	1.42E+02	2.51E+05	4.74E+01
Lead		5.2E+06	—	—	—
Lithium oxide	002	Trace	—	Trace	—
Mercury	002	—[a]	—[a]	—[a]	—[a]
Methyl alcohol	004	2.2E+03	7.51E-01	1.07E+02	3.57E-02
Methyl alcohol	001, 002	2.4E+03	8.01E-01	1.14E+02	3.82E-02
Methyl alcohol (total)	001, 002	4.6E+03	1.55E+00	2.22E+02	7.39E-02
Methylene chloride	001, 002, 003, 004	1.6E+05	1.20E+02	3.49E+04	2.61E+01
Polychlorinated biphenyls	003	Unknown	Unknown	Unknown	Unknown
Potassium chloride	005	1.4E+06	—	2.21E+05	—
Potassium dichromate	005	3.7E+04	—	5.84E+03	—
Potassium cyanide	002	—[b]	—	—[b]	—
Potassium nitrate	005	3.2E+07	—	5.05E+06	—
Potassium phosphate	005	7.7E+05	—	1.22E+05	—
Potassium sulfate	005	1.4E+06	—	2.21E+05	—
Silver	INEEL Waste	1.0E+00	—	—	—
Sodium chloride	005	3.0E+06	—	4.74E+05	—
Sodium dichromate	005	7.8E+04	—	1.23E+04	—
Sodium cyanide	002	—[b]	—	—[b]	—
Sodium nitrate	005	6.50E+07	—	1.03E+07	—
Sodium phosphate	005	1.40E+06	—	2.21E+05	—
Sodium sulfate	005	3.00E+06	—	4.74E+05	—
Tetrachloroethene	003	2.70E+07	4.46E+03	8.98E+06	1.48E+03
1,1,1-Trichloroethane	001, 002, 003, 004	2.20E+07	4.17E+03	7.31E+06	1.39E+03
Trichloroethene	003	2.50E+07	4.52E+03	8.31E+06	1.50E+03
Xylene	001, 002	5.20E+03	5.98E+00	2.48E+02	2.58E-01
Zirconium	INEEL Waste	1.5E+07	—	—	—

a. Clements (1982) reports that pint bottles of mercury were periodically disposed of through the Series 742 sludge waste stream. It is unknown how much, if any, mercury is in OU 7-10 or the OU 7-10 Glovebox Excavator Method Project area. A 1-pt bottle of mercury is assumed to be in the project area.
b. Two 25-lb packs of sodium cyanide or potassium cyanide pellets were distributed in Series 742 sludge waste drums buried in the Subsurface Disposal Area. It is assumed that the cyanide is in the project area.
INEEL = Idaho National Engineering and Environmental Laboratory OU = operable unit

Table 2-4. Evaluation of chemicals and potential agents that may be encountered.

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Organic Compounds						
Ascorbic acid (50-81-7)	None established	Ih, Ig	Eye irritation	Mild irritation of eyes only	No	Content Code 004, solid
Butyl alcohol (75-65-0) VD = 2.55 IE = 9.7 eV	TLV: 20 ppm	Ih, Ig, Con	Irritation eyes, skin, nose, throat; drowsiness, narcosis	Eyes, skin, respiratory system, central nervous system	No	Content Codes 001, 002, liquid
Carbon tetrachloride (56-23-5) VD = 5.3 IE-=11.5 eV	TLV: 5 ppm STEL: 10 ppm Ceiling: 25 ppm	Ih, Ig, S, Con	Irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, uncoordination; (potential occupational carcinogen)	Central nervous system, eyes, lungs, liver, kidneys, skin	Yes—NIOSH A2-ACGIH	Content Codes 001 through 004, liquid
Chloroform (67-66-3) VD = 4.12 IE = 11.4 eV	TLV: 10 ppm	Ih, Ig, S, Con	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; (potential occupational carcinogen)	Liver, kidneys, heart, eyes, skin, central nervous system	No	Content Codes 001 through 004, liquid
Diesel fuel (68476-34-6) VD = 1.0 IE = NA	TLV: 100 mg/m^3 (ACGIH—diesel fuel vapor or aerosol)	Ih, Ig, S, Con	Eye irritation; respiratory system changes; dermatitis	Eye, respiratory system	No	Fuel handling during refueling of excavator and other diesel powered equipment
Diesel exhaust (particulate aerodynamic diameter <1 μm)	TLV: 0.02 mg/m^3 (ACGIH 2002)	Ih	Respiratory, nose, throat or lung irritation with stinging and redness of the eyes; headache; nausea; dizziness; unconsciousness	Respiratory system	A2—ACGIH	Exhaust from excavator and other diesel-powered equipment

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[c]	Matrix or Source to Be Encountered During Project Operations
EDTA (tetrasodium) (64-02-8)	None established	Ig, S	Eye, skin, and mucous membrane irritation	Eyes, skin	No	Content Code 004, solid
Ethyl alcohol (64-17-5) VD = 1.6 IE = 10.47 eV	TLV: 1000 ppm	Ih, Ig, S, Con	Irritation eyes, skin, nose; headache, drowsiness, fatigue, narcosis; cough; liver damage; anemia; reproductive, teratogenic effects.	Eyes, skin, respiratory system, central nervous system, liver, blood, reproductive system	No	Content Code 004, liquid
Freon 113 (76-13-1) VD = 2.9 IE = 11.99 eV	TLV: 1000 ppm STEL: 1250 ppm	Ih, Ig, Con	Irritation skin, throat, drowsiness, dermatitis; CNS depressant and depression (in animals); cardiac arrhythmia, narcosis.	Skin, heart, CNS cardiovascular system	No	Content Code 003, liquid
Methyl alcohol (67-56-1) VD = 1.11 IE = 10.84 eV	TLV: 200 ppm	Ih, Ig, S, Con	Eye, skin, nose and throat irritation; headache; drowsiness; optic nerve atrophy; chest tightness; narcosis	Eyes, skin, respiratory system, CNS	No	Content Codes 001, 002, and 004
Methylene chloride (75-09-2) VD = 2.9 IE = 11.3 eV	TLV: 50 ppm OSHA (29 CFR 1910.1052, 2002) PEL: 25 ppm STEL: 125 ppm	Ih, Ig, S, Con	Eye and skin irritation; fatigue, weakness, somnolence, lightheadedness; numbness, tingle limbs; nausea	Eyes, skin, cardiovascular system, CNS	Yes—NIOSH A3—ACGIH	Content Codes 001 through 004, liquid
Polychlorinated biphenyls not specified (Aroclor-1254 used for toxicological evaluation purposes)	TLV: 0.5 mg/m^3—skin	Ih, Ig, S, Con	Eye irritation; chloracne; liver damage; reproductive effects	Skin, eyes, liver, reproductive system	Yes-NTP Yes-IARC No-OSHA	Content Code 003

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Tetrachloroethene (127-18-4) VD = 5.8 IE = 9.3 eV	TLV: 25 ppm STEL: 100 ppm	Ih, Ig, S, Con	Eye, skin, nose, throat, and respiratory system irritation; nausea; flush face, neck; vertigo, dizziness, uncoordination; headache, somnolence; skin erythema; liver damage	Eyes, skin, respiratory system, liver, kidneys, CNS	Yes—NIOSH	Content Code 003, liquid
1,1,1-Trichloroethane (71-55-6) VD = 4.6 IE = 11.1 eV	TLV: 350 ppm STEL: 450 ppm	Ih, Ig, Con	Eye and skin irritation; headache, lassitude, CNS depressant or depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eyes, skin, CNS, cardiovascular, liver	No A4—ACGIH	Content Codes 001 through 004, liquids
Trichloroethene (79-01-6) VD = 4.53 IE = 9.5 eV	TLV: 50 ppm STEL: 100 ppm	Ih, Ig, S, Con	Eye and skin irritation; headache, vertigo; visual disturbance, fatigue, giddiness, tremor, somnolence, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury	Eyes, skin, respiratory system, heart, liver, kidneys, CNS	Yes—NIOSH	Content Code 003, liquid
Xylene (total) (95-47-6) VD = 5.2 IE = 8.6 eV	TLV: 100 ppm STEL: 150 ppm	Ih, Ig, S, Con	Headache, loss of appetite, nervousness and pale skin; skin rash; eye damage; damage to bone marrow, causing low blood cell count; liver and kidney damage	Skin, eyes, blood, liver, kidneys	No	Content Codes 001 and 002, liquid

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Inorganic Compounds						
Asbestos (12001-29-5) VD–NA	TLV: 0.1 fiber/cc PEL: 0.1 fiber/cc Excursion Limit: 1.0 fiber/cc in 30 minutes (29 CFR 1926.1101, 2002)	Ih, Ig, Con	Irritation of eyes and skin, chronic asbestosis, restricted pulmonary function	Eyes, respiratory tract, lung lining	A1-ACGIH Yes-NTP Yes-IARC Yes-OSHA	Content Codes 335, 338, and 490
Beryllium (7440-41-7) VD = NA	TLV: 0.002 mg/m^3 STEL: 0.01 mg/m^3	Ih, Con	Berylliosis; anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis	Eyes, skin, respiratory system	Yes-NTP Yes-IARC NO-OSHA	Content Codes 001 and 002, solid
Cadmium (7440-43-9) VD = NA	TLV: 0.01 mg/m^3 Respirable: 0.002 mg/m^3 PEL: 5 $\mu g/m^3$ Action level: 2.5 $\mu g/m^3$ (29 CFR 1926.1127, 2002)	Ih, Ig	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia	Respiratory system, kidneys, prostate, blood	Yes-NTP Yes-IARC A2-ACGIH Yes-OSHA	Content Codes 001 and 002, solid
Lead (7439-92-1) VD = NA	TLV: 50 $\mu g/m^3$ **OR** A PEL in $\mu g/m^3$ equal to 400 divided by the number of hours worked per day for shifts longer than 8 hours. (29 CFR 1926.62, 2002)	Ih, Ig, Con	Weakness, lassitude, insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypotension	Eyes, GI, CNS, kidneys, blood, gingival tissue	No	Content Code (unknown), solid

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Lithium oxide (12057-24-8) VD = NA	None established	Ih, Ig, Con	Corrosive to eyes, skin, nose and throat	Skin and eyes (corrosive)	No	Content Code 002, solid (trace amounts only)
Mercury	TLV: 0.025 mg/m^3—skin STEL: 0.03 mg/m^3	Ih, Ig, S, Con	Irritation eyes, skin; cough, chest pain, dyspnea, bronchitis pneumonitis; tremor, insomnia, irritability, indecision, headache, fatigue, weakness; stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, CNS, kidneys	No	Content Code 002, liquid[f]
Potassium chloride (7447-40-7) VD = NA	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No	Content Code 005, solid
Potassium cyanide (150-50-8) VD = NA	PEL: 5 mg/m^3	Ih, Ig, S, Con	Irritation eyes, skin, upper respiratory system; asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased respiratory rate, slow gasping respiration; thyroid, blood changes	Eyes, skin, respiratory system, cardiovascular system, central nervous system, thyroid, blood	No	Content Code 002[g]
Potassium dichromate (7778-50-9) VD = NA	TLV: 0.05 mg/m^3 (chromate)	Ih, Ig, Con (chromate)	Respiratory, eyes, dermis, skin irritation, discoloration, mucous membrane ulcerating, perforated septum (chromate)	Skin (chromate)	Yes-NPT Yes-IARC No-Z List No-OSHA (chromate)	Content Code 005, solid

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Potassium nitrate (7757-79-1) VD = NA	None established	Ih, Ig, Con	Respiratory irritation, (Ig—GI pain, nausea and vomiting)	None identified, primarily a localized irritant	No	Content Code 005, solid
Potassium phosphate (7778-77-0) VD = NA	None established	Ih, Ig, Con	Eyes, minor skin irritation	None identified, primarily a localized irritant	No	Content Code 005, solid
Potassium sulfate (7778-80-5) VD = NA	None established	Ih, Ig	None identified	None identified	No	Content Code 005, solid
Silver (7440-22-4) VD = NA	TLV: 0.1 mg/m^3 TLV: 0.01 mg/m^3 (soluble compounds as silver)	Ih, Ig, Con	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	No	Content Code INEEL waste, solid
Sodium chloride (7647-14-5) VP-NA	None established	Ih, Ig, Con	Eyes, irritation of mucous membranes	None identified, primarily a localized irritant	No	Content Code 005, solid
Sodium cyanide (143-33-9) VD = NA	PEL: 5 mg/m^3	Ih, Ig, S, Con	Irritation eyes, skin; asphyxia; lassitude (weakness, exhaustion), headache, confusion; nausea, vomiting; increased respiratory rate; slow gasping respiration; thyroid, blood changes	Eyes, skin, cardiovascular system, central nervous system, thyroid, blood	No	Content Code 002[g]
Sodium dichromate (10588-01-9) VD = NA	TLV—0.05 mg/m^3 (chromate)	Ih, Ig, Con (chromate)	Respiratory, eyes, skin irritation or ulcerating (chromate)	Kidneys, liver (chromate)	Yes-NPT Yes-IARC Yes-Z List Yes-OSHA (chromate)	Content Code 005, solid

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Sodium nitrate (7631-99-4) VD = NA	None established	Ih, Ig, Con	Respiratory, eyes, dermis, (Ih/Ig may cause cyanosis)	None identified, primarily a localized irritant	No	Content Code 005, solid
Sodium phosphate (7558-79-4) VD = NA	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No	Content Code 005, solid
Sodium sulfate (7757-82-6) VD = NA	None established	Ih, Ig, Con	Respiratory, eyes, dermis	None identified, primarily a localized irritant	No	Content Code 005, solid
Zirconium (7440-67-7) VD = NA	TLV: 5 mg/m^3 STEL: 10 mg/m^3	Ih, Con	Skin, lung granulomas; irritation skin, mucous membrane; X-ray evidence of retention in lungs	Skin, respiratory system	No	Content Code INEEL waste, solid
Radionuclides (as listed in Table 2-1)						
Radionuclides (radiation fields)	ALARA, dose limit, in accordance with RWP Posting of radiation areas in accordance with INEEL *Radiological Control Manual*[b] Thermoluminescent dosimeters will be used to measure whole body TEDE.	Whole Body	Alarming electronic dosimetry or stationary radiation monitors or alarms, criticality alarm, and elevated readings on direct-reading instruments.	Blood-forming cells, GI tract, and rapidly dividing cells	Yes—IARC	OU 7-10 waste and waste streams, assay system
Radionuclides (fixed and removable surface contamination)	ALARA, dose limit, in accordance with RWP Posting of contamination areas in accordance with PRD-183	Ih, Ig, broken skin	Alarming CAMs, high counts on portable air samplers, direct-reading instruments, swipe counter (scaler), and alarm indication on personal contamination monitors.	GI tract, ionization of internal tissue through uptake of radionuclides	Yes—IARC	Contamination from OU 7-10 waste and waste streams

Table 2-4. (continued).

Material or Chemical (Chemical Abstract Service Number, Vapor Density and Ionization Energy)[a]	Exposure Limit[b] (PEL/TLV)	Routes of Exposure[c]	Indicators or Symptoms of Over-Exposure[d] (acute and chronic)	Target Organs and System	Carcinogen? (source)[e]	Matrix or Source to Be Encountered During Project Operations
Radionuclides (airborne radioactivity)	ALARA, dose limit, in accordance with RWP 10% of derived air concentration for specific radionuclide selected (10 CFR 835, 2002) Posting of airborne radioactivity areas in accordance with PRD-183	Ih, Ig, broken skin	Alarming CAMs, high counts on portable air samplers and personal air samplers.	GI tract, ionization of internal tissue through uptake of radionuclides	Yes	OU 7-10 waste and waste streams. Entry into Retrieval Confinement Structure or contaminated areas of Packaging Glovebox System.

a. Material safety datasheets for chemicals other than waste types are available at the project.
b. ACGIH (2002); 29 CFR 1910 (2002), 29 CFR 1926 (2002); and substance-specific standards.
c. (Ih) inhalation; (Ig) ingestion; (S) skin absorption; (Con) contact hazard.
d. (Nervous system) dizziness, nausea, lightheadedness; (dermis) rashes, itching, redness; (respiratory) respiratory effects; (eyes) tearing, irritation.
e. If yes, identify agency and appropriate designation (ACGIH A1 or A2, NIOSH, OSHA, IARC, NTP).
f. Clements (1982) reports that pint bottles of mercury were periodically disposed of through the Series 742 sludge waste stream. It is unknown how much, if any, mercury is in OU 7-10 or the OU 7-10 Glovebox Excavator Method Project area. A 1-pt bottle of mercury is assumed to be in the project area.
g. Two 25 lb packs of sodium cyanide or potassium cyanide pellets were distributed in Series 742 sludge waste drums buried in the Subsurface Disposal Area. It is assumed that the cyanide is in the project area.

ACGIH = American Conference of Governmental Industrial Hygienists
ALARA = as low as reasonably achievable
CAM = constant air monitor
CFR = *Code of Federal Regulations*
CNS = central nervous system
GI = gastrointestinal
ARC = International Agency for Research on Cancer
IH = industrial hygienist
INEEL = Idaho National Engineering and Environmental Laboratory
NIOSH = National Institute of Occupational Safety and Health
NTP = National Toxicology Program
OSHA = Occupational Safety and Health Administration
OU = operable unit
PEL = permissible exposure limit
PRD = program requirements document
RWP = radiological work permit
TEDE = total effective dose equivalent
TLV = threshold limit value

Table 2-5. Summary of project operational activities, associated hazards, and mitigation.[a]

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
Excavation Operations (RCS)		
• Overburden removal • Waste retrieval • Underburden sampling • Sample handling and transportation	Radiological: Contamination—OU 7-10 waste material. Radiation exposure—OU 7-10 waste material. Airborne radioactivity—Dust from waste material. Criticality—Accumulation of high FGE material with moderator and proper geometry.	Safety-significant systems and engineering controls (confinement) of the RCS, DSS, controlled access, stationary continuous air and radiation monitors, criticality monitor and alarm, TPRs with hold points, qualified equipment operator, RWP, direct-reading instruments, compliance with MCP-183, "Safeguards and Security (Draft),"[b] radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
	Chemical and nonradiological contaminants—OU 7-10 waste material, airborne contaminants, chemical use for project RCS operations, equipment operation (CO), excavator fuel, preventive maintenance.	Safety-significant systems and engineering controls (confinement) of the RCS, DSS, controlled access, area monitors and direct-reading instruments, TPRs with hold points, qualified equipment operator, JSAs, MSDS for all chemicals used, active exhaust system for excavator, and PPE.
	Pinch points, and struck-by or caught-between hazards—Equipment movement and vehicle traffic, forklift movement, soil sack loading and handling, empty drum handling.	Technical procedures, equipment inspections, qualified equipment operators (hoisting and rigging) and forklift operators, backup alarms, JSAs, designated traffic lanes and areas, watch body position, and PPE.
	Lifting and back strain—Staging excavator stands and end effectors and support materials, handling core sampling equipment, manual excavation of overburden,	Mechanical equipment to lift and position heavy items, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, body position awareness, and use of stands or designed jigs or fixtures for holding heavy items during manipulation tasks.
	Heat and cold stress—Working outdoors and tasks requiring use of protective clothing and respiratory protection.	Industrial hygienist monitoring, PPE, training, work and rest cycles as required (MCP-2704), stay times documented on SWP (or equivalent).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Tripping hazards and working and walking surfaces—Uneven surfaces and terrain, ice-, snow-, mud-covered or wet surfaces, probes in pit, lines and cords, and ladders.	Good housekeeping, awareness of walking surfaces, salt and sand icy areas (where required), and use of nonskid or high-fiction materials on walking surfaces, lines and cords maintained out of established aisles and walkways, proper footwear, and three-point contact when ascending and descending ladder.
	Stored energy sources—Elevated materials, electrical, compressed gases, hoisting and rigging (soil sacks), fire (refueling), running vehicles.	Secure all materials stored at elevated locations, identify and mark all utilities, ensure all lines and cords are checked for damage and continuity, use GFCI (circuit or receptacle) for all outdoor equipment and for all temporary installations, comply with minimum clearances for overhead lines, and secure compressed cylinders, caps, and bottles before movement, conduct inspections of equipment, grounding and bonding during all refueling operations, set brake and use tire chalks where appropriate, and do not leave any running vehicles or equipment unattended.
	Hazardous noise—Areas around equipment and when operating equipment.	Source identification and labeling, Industrial Hygiene sound level monitoring and dosimetry, isolation, and PPE (as required).
Glovebox Operations (PGS)		
• Waste packaging • Waste Sorting • Waste handling • Drum preparation • Drum load out	Radiological: Contamination—OU 7-10 waste material. Radiation exposure—OU 7-10 waste material and radiological sources Criticality—Overloaded drum.	Safety significant systems and engineering controls (confinement) of the PGS, controlled access, air and radiation monitors, FMM, TPRs with hold points, qualified glovebox operators, RWP, direct-reading instruments, compliance with MCP-183[b] radiological posting requirements, PPE, use of TLDs and supplemental dosimetry, and contamination surveys.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Chemical and nonradiological contaminants—OU 7-10 waste material handling, chemical use for project PGS operations, airborne contaminants, equipment operation, refueling, and preventive maintenance.	Safety significant systems and engineering controls (confinement) of the PGS, controlled access, area monitors and direct-reading instruments, TPRs with hold points, qualified glovebox operators, JSAs, MSDSs for all chemicals used, and PPE.
	Pinch points, struck-by, or caught-between hazards—Equipment, hoist and drum movement and forklift operations.	Technical procedures, equipment inspections, designated operators (hoist), qualified forklift operators, backup alarms, JSAs, designated traffic lanes and areas, watch body position, and PPE.
	Lifting and back strain—Lifting glovebox loadout cover, handling and positioning waste in glovebox, drum loadout, drum preparation, waste sorting, and sample movement.	Mechanical lifting devices (e.g., hoist) used to lift and move heavy waste items and loadout cover, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, and awareness of body position. Ergonomic assessments performed by IH as deemed appropriate.
	Heat and cold stress—Support work outdoors	Industrial Hygiene monitoring, PPE, training, and work-rest cycles (as required).
	Tripping hazards and working and walking surfaces—Uneven surfaces and terrain, ice-, snow-, mud-covered or wet surfaces, material storage on elevated work platforms, lines and cords, and ladders.	Good housekeeping, awareness of walking surfaces, salt and sand icy areas (where required), and use of nonskid or high-fiction materials on walking surfaces, proper footwear, lines and cords maintained out of established aisles and walkways, and three-point contact when ascending and descending ladder.
	Stored energy sources—Elevated materials (drums and hoisted materials and waste), electrical, running industrial vehicles (e.g., forklift).	Secure all materials stored at elevated locations, inspect all lines and cords before use, use GFCI (circuit or receptacle) for all outdoor equipment and where liquids may be present, conduct inspections of tools, set brake and use tire chalks where appropriate, and do not leave any running vehicles or equipment unattended.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Cutting, crushing, and pinch points—Glovebox tools and equipment, sizing operations, debris handling, sampling.	Follow manufacturer's operating instructions, keep areas clear of nonessential materials, wear required PPE (as listed in the JSA), be aware of body position and other glovebox personnel before starting and during tool use.
	Hazardous noise—Sizing tools and during operation of the forklift.	Source identification and labeling, IH sound level monitoring or dosimetry, isolation, and PPE (as required).
General Project Operational Support Tasks		
• Drum handling • Forklift operations • Waste transportation and storage • Waste inspections • Drum assay	Radiological: Contamination—OU 7-10 waste material. Radiation exposure—OU 7-10 waste material. Assay system operation—drum assay for storage.	Engineering controls, controlled access, TPRs, qualified positions (where required), RWP, direct-reading instruments, collection and counting of swipes, compliance with MCP-183[b] radiological posting requirements, interlocks (assay system), PPE, use of TLDs and supplemental dosimetry, and contamination surveys.
	Chemical and nonradiological contaminants—OU 7-10 waste container handling, chemical use for project operations, equipment operation, refueling, preventive maintenance, cryogenics (LN_2) for assay detector cooling.	Engineering controls, controlled access, area monitors and direct-reading instruments, TPRs, JSAs, MSDS for all chemicals used, compliance with PRD-5038, requirements for cryogenic use and handling, and PPE.
	Pinch points, struck-by or caught-between hazards—Equipment, drum movement, forklift operations, material handling tasks.	Technical procedures, equipment inspections, qualified forklift operators, JSAs, backup alarms, designated traffic lanes and areas, proper body position, and PPE.
	Lifting and back strain—Material handling, handling and positioning waste containers and sample movement.	Mechanical lifting devices (e.g., forklift) to lift and move heavy waste items, proper lifting techniques, two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward or unbalanced, and awareness of body position. An IH may perform ergonomic assessments as deemed appropriate.
	Heat and cold stress—Support work outdoors	Monitoring by IH, PPE, training, and work-rest cycles (as required).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Tripping hazards and working and walking surfaces—Uneven surfaces and terrain, ice-, snow-, mud-covered or wet surfaces, lines and cords, entry into waste storage area, and ladders.	Good housekeeping, awareness of walking surfaces, salt and sand icy areas (where required), and use nonskid or high-fiction materials on walking surfaces, proper footwear, keep lines and cords out of established aisles and walkways, and three-point contact when ascending and descending ladder.
	Stored energy sources—Elevated materials (stored drums and waste), compressed gas (P_{10}), running industrial vehicles (forklift).	Secure all materials stored at elevated locations, inspect all lines and cords before use, use GFCI (circuit or receptacle) for all outdoor equipment and where liquids may be present, secure compressed cylinders, caps, and bottles before movement, conduct inspections of tools, set brake and use tire chalks where appropriate, and do not leave any running vehicles or equipment unattended.
	Hazardous noise—Areas around equipment and when operating some equipment or while using hand tools.	Source identification and labeling, IH sound level monitoring or dosimetry, isolation, and PPE (as required).
Decontamination Tasks		
• Operational tools and equipment • RCS and PGS preliminary decontamination	Radiological: Contamination—OU 7-10 waste material. Radiation exposure—Hot particles or dose rate associated with decontamination waste and debris.	Radiological work permit, RCT surveys, hold points, direct-reading instruments, collection and counting of swipes, compliance with MCP-183[b] radiological posting requirements, PPE, and use of dosimetry or survey requirements, and ALARA principles (Section 4).
	Chemical and nonradiological contaminants—Contaminants associated with decontamination process and secondary waste streams generated.	Controlled areas, JSAs, SWPs (as required), air monitoring and sampling, direct-reading instruments, TPRs, and PPE.
	Pinch points, struck-by, and caught-between—Positioning items to be decontaminated.	Job safety analyses, TPRs, watch body position, and PPE.
	Lifting and back strain—Moving and positioning components and decontamination waste containers.	Use mechanical lifting devices where possible, proper lifting techniques and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or in awkward or unbalanced situations, and an IH will conduct ergonomic evaluation of tasks (as required).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Heat and cold stress—Working outdoors and in PPE	Monitoring by IH, PPE, training, work and rest cycles as required (MCP-2704), stay times documented on SWP (or equivalent).
	Tripping hazards and working and walking surfaces—Uneven surfaces and terrain, ice- and snow-covered and wet surfaces.	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole.
	Electrical—Use of electrical equipment or equipment in area where water of wet surfaces are present.	Use of GFCI outlets or extension cords outdoors and where water or wet surfaces are present. Use of barrier material to isolate overspray.
Maintenance of Project Systems		
• Electrical • Piping, valves, fittings, hoses • Communication • Heating, and ventilating • Mechanical equipment	Radiological contamination—Contact with waste material, contaminated equipment, and components. Radiation exposure—In close proximity to waste containers and contamination with associated dose rate.	Engineering controls (confinement), RWP, RCT surveys, work package hold points, direct-reading instruments, collection and counting of swipes, compliance with MCP-183[b] radiological posting requirements, PPE, and use of dosimetry and survey requirements, and ALARA principles (Section 4).
	Chemical and inorganic contaminants—Contact with waste material, contaminated equipment, and components, hydraulic fluids, fuel, and use of chemicals associated with maintenance tasks.	Controlled areas, JSAs, SWPs (as required), work package hold points, air monitoring and sampling, direct-reading instruments, MSDS for all chemicals, and PPE.
	Pinch points, struck-by or caught-between hazards—Equipment, drum movement, forklift operations, material handling tasks.	Technical procedures, equipment inspections, qualified forklift operators, JSAs, designated traffic lanes and areas, backup alarms, watch body position, and PPE.
	Lifting and back strain—Moving and positioning components.	Use mechanical lifting and positioning devices, proper lifting techniques and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward and unbalanced, IH conduct ergonomic evaluation of tasks (as required).
	Heat and cold stress—Working outdoors and in PPE	Industrial hygienist monitoring, PPE, training, work-rest cycles as required (MCP-2704), stay times documented on SWP (or equivalent).

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Tripping hazards and working-walking surfaces—Uneven surfaces and terrain, ice- and snow-covered and wet surfaces, and ladders.	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, wear adequate footwear with traction sole, and three-point contact when ascending and descending ladder.
	Hoisting and rigging—Equipment and component movement and placement, project overhead hoists.	Qualified operators; equipment and rigging inspections; hoisting and rigging operations in accordance with MCP-6501, MCP-6502, MCP-6503, MCP-6504, and MCP-6505; and applicable facility supplement.
	Stored energy—Electrical, mechanical, thermal, elevated materials, pressurized systems, cylinders, and fire systems.	Piping and conduit labeling, LO/TO training, Standard-101 work packages, LO/TO in accordance with MCP-3650, MCP-3651, and PRD-5051.
	Elevated work or work near open excavation.	Fall protection training, use of fall protection system and devices, fall protection competent person, and follow all requirements of PRD-5096.
Facility Lay-up		
• Backfill excavation • Fix removable contamination • Final decontamination on RCS and PGS • Secure Waste Management Facility-671 Weather Enclosure Structure	Radiological: Contamination—OU 7-10 waste material. Radiation exposure—Hot particles or dose rate associated with decontamination waste and debris.	Engineering controls (ventilation), controlled areas, TPRs, RWP, RCT surveys, fixed and portable air sampling instruments, hold points, direct-reading instruments, collection and counting of swipes, compliance with MCP-183[b] radiological posting requirements, PPE, and use of dosimetry and survey requirements, and ALARA principles (Section 4).
	Chemical and nonradiological contaminants—Contaminants associated with decontamination process and secondary waste streams generated, decontamination solutions, spray fixative compound(s), grout, fuel, hydraulic fluids, compressed gas cylinders.	Controlled areas, TPRs, JSAs, SWPs (as required), MSDS for chemicals used for decontamination, fixative, grout and fluids drained, air monitoring and sampling, direct-reading instruments, PPE.
	Pinch points, struck-by, or caught-between—Vehicle and equipment movement, material and equipment handling, use of hand and power tools.	Vehicles use designated traffic lanes and ramps, backup alarms, JSAs, TPRs, watch body position, and wear PPE.

Table 2-5. (continued).

Activity or Task	Associated Hazards or Hazardous Agent	Hazard Mitigation
	Lifting and back strain—Moving and positioning grout hose, lifting components, positioning equipment, carrying decontamination and fixadent equipment and supplies or components.	Use mechanical lifting devices where possible, proper lifting techniques and two-person lifts if items are over 50 lb (or one-third of the person's body weight, whichever is less) or awkward and unbalanced, IH conduct ergonomic evaluation of tasks (as required).
	Heat and cold stress—Working outdoors and in PPE	Industrial hygienist monitoring, PPE, training, work-rest cycles as required (MCP-2704), stay times documented on SWP (or equivalent).
	Tripping hazards and working-walking surfaces—Uneven surfaces and terrain, ice- and snow-covered and wet surfaces, plastic sheeting, cords, hoses, and lines, and ladders.	Awareness of walking surfaces, salt and sand icy areas, and use nonskid or high-fiction materials on walking surfaces, keep lines and cords out of established aisles and walkways, wear adequate footwear with traction sole.
	Electrical—Use of electrical equipment or equipment in area where water of wet surfaces are present.	Use of GFCI outlets or extension cords outdoors and where water or wet surfaces are present. Use of barrier material to isolate overspray.

a. All hazards will be identified, evaluated and controls established in accordance with PRD-25, "Activity Level Hazard Identification, Analysis, and Control," requirements. Additionally, project assigned industrial hygienist, safety professional, and Radiological Control personnel will be available to assist with the PRD-25 process and to assist in the develop of TPRs, work orders or packages, and permits associated with project operational activities.

b. MCP-183, "Safeguards and Security (Draft)."

ALARA = as low as reasonably achievable
DSS = dust-suppression system
GFCI = ground-fault circuit interrupter
JSA = job safety analysis
LO/TO = lockout and tagout
MCP = management control procedure
MSDS = material safety datasheet
OU = operable unit
PGS = Packaging Glovebox System
PPE = personal protective equipment
PRD = program requirements document
RCS = Retrieval Confinement Structure
RCT = radiological control technician
RWP = radiological work permit
SWP = safe work permit
TLD = thermoluminescent dosimeter
TPR = technical procedure